UNIVERSITY OF PENNSYLVANIA

THE DETERMINATION OF THE GRAPHIC FORMS AND THE FREQUENCIES OF THE FORMS EMPLOYED IN THE CURRENT READING MATTER OF THE NON-SPECIALIST

WALTER H. MAGILL

A THESIS

IN EDUCATION

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

PHILADELPHIA
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ACKNOWLEDGMENT

The writer takes this occasion to acknowledge his indebtedness for valuable constructive criticism and suggestions in the conduct of this study to the members of his thesis committee, Professors William C. Ash, Francis M. Garver, Arthur J. Jones, and Thomas Woody.

I

Origin of the Problem

The attention of the writer was directed to this investigation through an attempt by him to develop a test for mechanical drawing instruction in junior and senior high schools. It became apparent in the course of this attempt that no valid basis existed for the formulation of the content of such a test; textbooks were found to be few in number and variable in content and courses of instruction empiric and largely formalistic.

A realization of this state of affairs brought a determination to attempt to remedy it in some measure. In the consideration of the general problem of determining what should be the content of mechanical drawing courses the phase which presented itself as the most appropriate and profitable for first attack was the demand made upon the comprehension of the non-specialist by drawings included in the reading matter which comes into his hands. The type of drawing used by the vocational specialist varies significantly with the vocation, and only a small fraction of those who attend high school are likely to use drawing as vocational specialists. It seems desirable, therefore, to determine first the instructional needs of the non-specialist as a basis for a first course in drawing, with the expectation that the needs of the prospective specialist will be met by supplementary specialized courses.

The drawing needs of the non-specialist are chiefly those of comprehension. Life occasions calling for expression through drawing are obviously infrequent and restricted to a rather small minority of persons. The most frequent and most extensive occasions for comprehension which the non-specialist meets are undoubtedly those connected with the printed reading matter which comes into his hands. The problem which the writer has selected for attack, therefore, is the determination of the forms of drawing included in the reading matter of the non-specialist and the relative frequencies of the respective forms.

From the point of view of use to the non-specialist the distinction between mechanical drawing and other conventionalized

forms of drawing is largely an arbitrary one and the usefulness of this investigation promised to be proportionately increased by expanding the concept of drawing as employed in it to include all forms of printed communication intermediate between pictorial illustrations and the purely abstract symbols of written speech. Such forms will be referred to as "graphic forms". They are distinguished from the purely pictorial by containing some degree of the conventional and they include all symbols not regularly associated with formal written speech. All types of graphic forms so defined were included within the scope of the study except musical notation, which is specifically excepted because of its peculiar nature and use.

Statement of the Problem

The problem then becomes:—"The determination of the graphic forms and the frequencies of the forms employed in the current reading matter of the non-specialist."

Method of Procedure

Sources of Data

The first problem which confronted the investigator was that of determining a method of obtaining a comprehensive list of the graphic forms employed in the current reading matter of the non-specialist. Seven fairly distinct and prominent classes of reading matter presented themselves,—magazines, newspapers, automobile instruction manuals, instruction manuals for household machines and devices, books, street car advertisements, and miscellaneous advertising circulars. The last three of these were omitted for reasons which follow. Each of the others presented a different problem and will be discussed separately.

Street Car Advertisements and Miscellaneous Advertising Circulars

No survey was made of street car advertisements nor of miscellaneous advertising circulars because it was assumed that the inclusion of the results of such a survey would introduce an

added complication into the study without increasing its value. This assumption was based on the following grounds: (a) Familiarity with street car advertisements and miscellaneous advertising circulars is sufficiently great and sufficiently general to justify the conclusion, without a special survey, that graphic forms are but rarely used in them and that when used they are of simple, uncomplicated types commonly employed in magazines and newspapers. (b) It would be necessary to calculate the frequency significance of the forms employed on a different basis from that employed with the other types of printed matter and no means of calculation was discovered which would be comparable to, or as reliable as, the circulation figures of magazines and newspapers.

Books

It was the original intention to include in this survey a sampling of books used by the non-specialist but no satisfactory method of determining representative books read by the non-specialist or of giving a numerical significance to the frequency and distribution of graphic forms employed in them could be discovered. A number of factors tend to make magazines more representative of current reading interests than are books; single numbers are much less expensive and, through subscription and news-stands, are much more readily and widely available; the time consumed in the publication of magazines is far less than for books so that they are much closer in point of time to current interests; magazines, through their advertising, are much more easily financed than are books so that each new interest results in an outcropping of magazines devoted to it almost as soon as the interest appears, notable recent instances are amateur aviation and amateur television, both of which have had special magazines devoted to them when interest had developed no farther than the first stages of popular curiosity. The only possible reason which has occurred to the investigator for including books in addition to periodicals in the survey is that current interests may lead readers to read old books containing graphic forms not in current use. Such a study as the present one to be of value must be

not only extensive but discriminating; it must show not only what graphic forms may possibly be met but also the degree of probability of meeting each form. While the extensiveness of the present study might possibly have been increased by the inclusion of books, its discriminating character would be much weakened by the absence of evidence regarding the extent and frequency of the reading of books. Books were not included in the survey, therefore, under the assumption that any advantage arising from the possible greater extensiveness would be much more than offset by the inevitable reduction in discrimination.

Instruction Manuals for Household Devices and Apparatus

Instruction manuals of electrical and mechanical devices and apparatus in the stocks of the Wanamaker Store, Philadelphia, and of the retail display rooms of the Philadelphia Electric Co., were inspected for the presence of graphic forms but none of any consequence was found. Since these two stocks are probably the most extensive and diversified of any in Philadelphia and probably embrace the most significant mechanical and electrical household devices and apparatus it was deemed unnecessary to carry this phase of the investigation farther.

Magazines

Method of Selection

According to the American Newspaper Annual and Directory[1] there are published in the United States nearly 7000 magazines. The problem of making a selection from these which would contain a comprehensive list of graphic forms contained in magazines read by the non-specialist uncomplicated by forms pertinent only to specialists was one for which only an indirect and imperfect solution has been found. There is no assurance that lists of magazines styled general are truly general, there is reason to believe that magazines designed for specialists are also read in some measure by non-specialists, reading habits have

[1] Compiled and published by N. W. Ayer & Son, Philadelphia.

been shown to vary widely among different classes of people and in different sections of the country.[2] The method adopted after an investigation of the possibilities of the situation was that of beginning with a survey of a group of magazines probably most representative of general reading interests and proceeding beyond this group through groups of magazines progressively less representative until a considerable number of magazines made no additions of consequence to the types of graphic forms already found. This procedure was adopted on the hypothesis that there is a fairly definite list of graphic forms employed in the reading matter of the non-specialist and that ultimately, as the survey proceeded from group to group, a zone would be found which yielded no significant additions to the forms already discovered, indicating that this list had been comprehended within the survey. It was anticipated that as the survey progressed the inclusion of magazines intended for the technically trained specialist might after a certain point result in a progressive increase in the types of forms found. The forms found in such magazines, however, could be readily separated from the others for special consideration as to their inclusion since technical magazines are so classified in various lists.

Lists of "General" Magazines

The first step in the procedure was to collect as many independent lists of magazines for the general reader as could be discovered. Six such lists were found, or formed as follows:

1. Periodicals included in "The Reader's Guide to Periodical Literature" ..... 113 magazines
2. Periodicals in the price list of the Mutual Subscription Agency of Philadelphia ..... 190 magazines
3. "Periodicals for the Small Library", published by the American Library Association ..... 202 magazines
4. All magazines taken by the thirty Philadelphia branch public libraries ..... 305 magazines

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[2] Cf. Gray, W. S. and Munroe, R., *The Reading Interests and Habits of Adults*, 1929, The Macmillan Co., New York City.

5. Periodicals listed in the "American News Trade Journal" (October, 1927).....530 magazines
6. List of "General Magazines" given in the "Standard Rate and Data Service".....579 magazines

Description of the Lists

1. The list of periodicals included in the Reader's Guide to Periodical Literature is annually sumitted to libraries for revision and therefore represents librarians' concepts of current interest in the more serious forms of periodical literature.

2. The Mutual Subscription Agency of Philadelphia is a reliable agency of long standing, having been founded in 1877. Its list is therefore presumably representative of home interests in magazine reading in the Philadelphia metropolitan area.

3. Periodicals for the Small Library, fifth edition, by Frank K. Walter, published by the American Library Association, Chicago, Illinois, 1928, contains a list of magazines formulated in 1927 for the purpose indicated by its title. It was compiled from returns secured from 212 library workers, employed in or interested in, small libraries. Place was given on the list only to those magazines which received ten affirmative votes in excess of all opposition. This list therefore represents library workers' opinions of reading interests of the frequenters of small libraries.

4. Philadelphia, in addition to a large central public library, maintains a branch library in each of thirty districts into which the city is divided for the purpose. Since the list of magazines of the central library was too extensive to be indicative of the interests of the general reader, containing well over three thousand titles, the lists of the branch libraries were combined into a single list to represent current interests in the various sections of the city. Each of the lists is revised once a year when the subscriptions are renewed according to the judgment of the local librarian regarding local reading interests. These judgments are based on the extent of use of the magazines but are more or less impressionistic in nature.

5. The magazine list of the *American News Trade Journal* published by the American News Co., New York, is the one

from which the Union News Co. and other similar agencies select magazines for newsstand sale. It therefore represents interests of this section of the reading public. *

6. The Standard Rate and Data Service of Chicago, Illinois, publishes monthly a list of the newspapers and magazines of the United States with related data for the use of advertising agencies. It includes a list of "general" magazines. This list was included as representing general magazines from the point of view of the advertiser.

It is to be noted that list number four is based on the reading interests of Philadelphia city proper and list number two on the interests of the Philadelphia metropolitan area and that the other four are national in scope.

The above lists were collected near the end of the year 1927 in preparation for the survey which was to be conducted during the calendar year 1928 and therefore they represent the situation as it existed at that time.

The next step in the procedure was to combine the six lists given above into a single master list,* which was then divided into sub-lists one to six. In sub-list six were included those magazines which appeared in all of the six component lists; in sub-list five were included those magazines which appeared on any five of the component lists; in sub-list four were included magazines which appeared on any four of the component lists, and so on.

The number of publications on each sub-list and the distribution of these among the six component lists is represented on Graph 1. It will be noted that an appreciable number of publications from each of the component lists appears on each of the sub-lists, which affords some contributory evidence in favor of the representative nature of both the component and sub-lists.

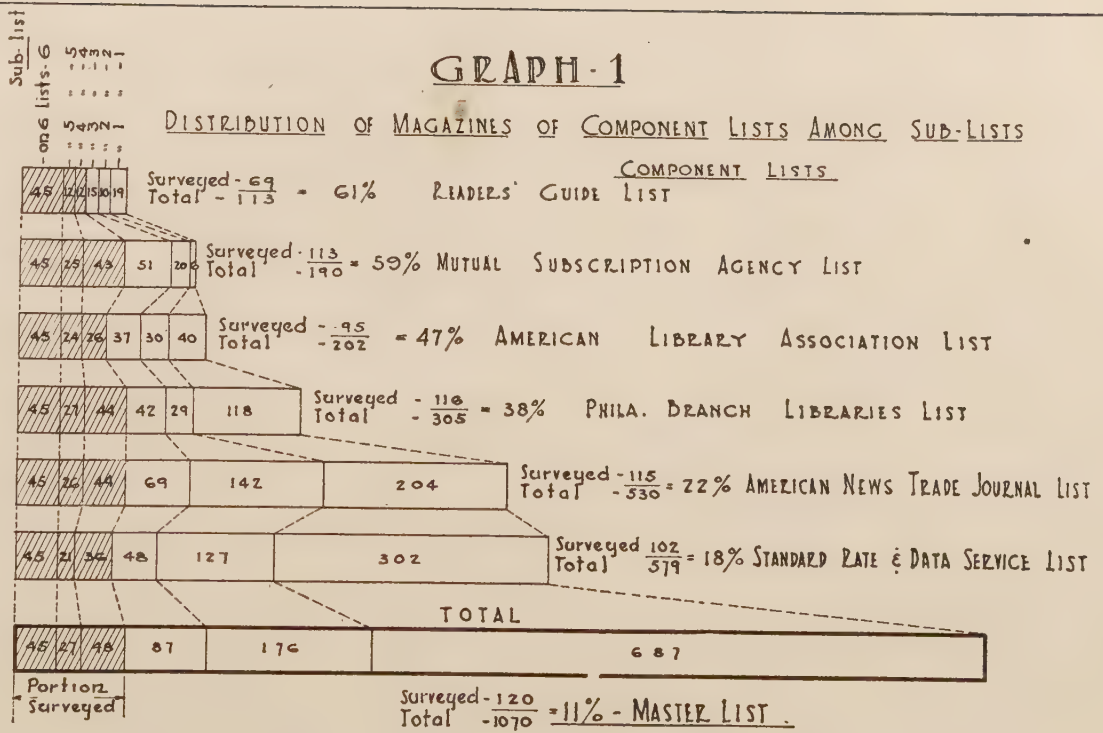
The Survey of Magazines

The survey of magazine contents was then begun. Tally

* The Master List of 1070 magazines is filed with the other raw data of the study in the library of the University of Pennsylvania. It shows the titles of the magazines included in each sub-list and the average circulation figures per issue for each magazine for the year 1928.

GRAPH-1

DISTRIBUTION OF MAGAZINES OF COMPONENT LISTS AMONG SUB-LISTS


Sub-List
one lists-6
Component Lists
Surveyed - 69 / Total - 113 = 61% Readers' Guide List
45 12 15 10 19
Surveyed - 113 / Total - 190 = 59% Mutual Subscription Agency List
45 25 43 51 206
Surveyed - 95 / Total - 202 = 47% American Library Association List
45 24 26 37 30 40
Surveyed - 116 / Total - 305 = 38% Phila. Branch Libraries List
45 27 44 42 29 118
Surveyed - 115 / Total - 530 = 22% American News Trade Journal List
45 26 44 69 142 204
Surveyed 102 / 579 = 18% Standard Rate & Data Service List
45 21 34 48 127 302
TOTAL
45 27 48 87 176 687
Portion Surveyed
Surveyed - 120 / Total - 1070 = 11% - Master List.

sheets were prepared which listed across the top the name of the magazine and the date of issue; a separate key strip wtih the same ruling as the tally sheets was prepared upon which could be written the names of the graphic forms as found. (See sample tally sheet and key strip.) The employment of the key strip eliminated the necessity of copying the names of the forms as found on each of the many tally sheets and insured uniformity and greater accuracy in tallying since the strip could be placed adjacent to the column in which the tallies were being made. Tallies for each issue were kept separately and the tallies for advertisements were kept separate from those for content* by using an "x" for each item found in an advertisement and a dot for each item found in content.

In order that the survey might be as impartial as possible, effort was made to conduct it with entirely unbiassed attention, listing the forms which might be found as they occurred without preperception and without regard to their apparent or presumed educational significance or triviality. This proved to be more difficult than might be supposed. The writer has had considerable experience with the various types of graphic forms and in scanning the great masses of printed matter included within the survey he found that some of the more commonplace elements were so familiar as to be confused with the purely pictorial and so overlooked for a time. This necessitated a resurvey of portions of the material to make corrections for oversight.

Analysis and Classification of Graphic Forms

In recording the findings some form of classification was found to be necessary because virtually no two specific forms were identical and they could be treated collectively only on the basis of similarities, major and minor. After some preliminary experimentation it was found that nearly all forms divided themselves quite satisfactorily into five major classes already well recognized:—maps, mechanical drawings, architectural drawings, electric circuit diagrams and graphs.

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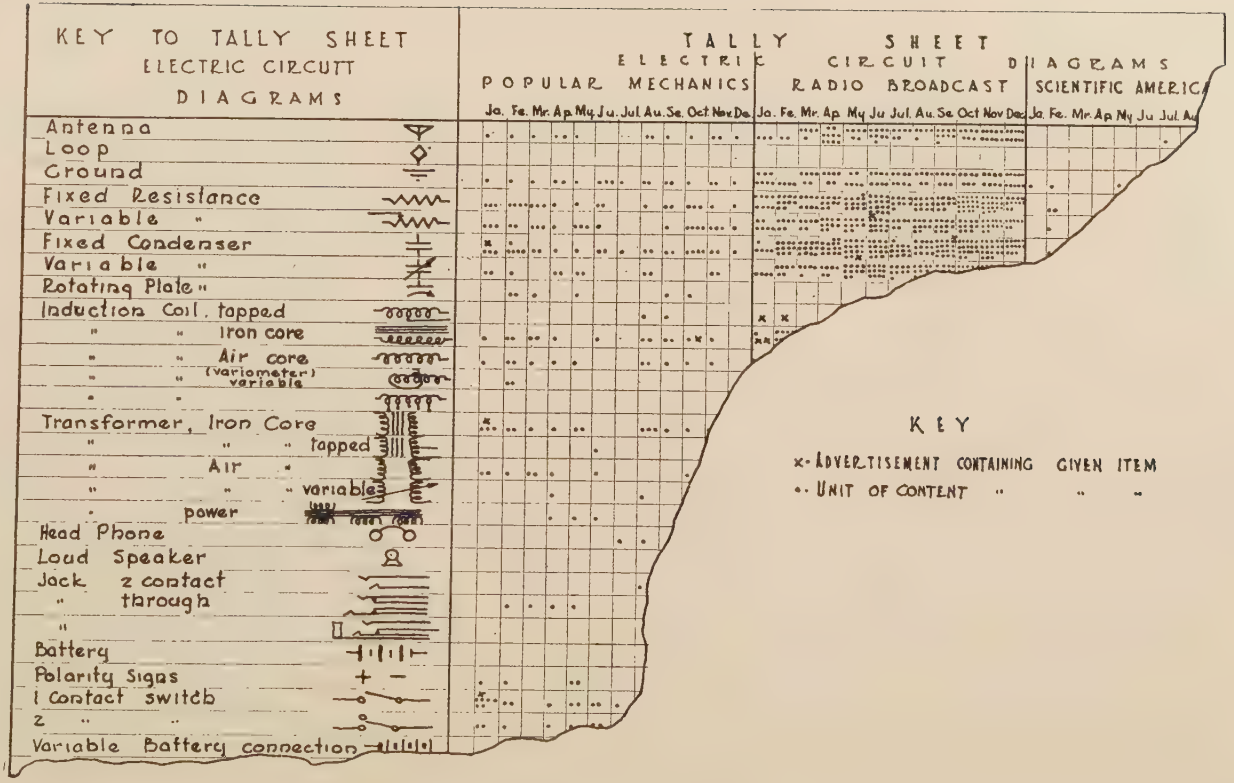
* The word "content" is used arbitrarily in this study, for want of a better, to denote non-advertising matter.


KEY TO TALLY SHEET
ELECTRIC CIRCUIT DIAGRAMS
Antenna
Loop
Ground
Fixed Resistance
Variable "
Fixed Condenser
Variable "
Rotating Plate "
Induction Coil, tapped
" " Iron core
" " Air core
" " (variometer) variable
" "
Transformer, Iron Core
" " " tapped
" Air "
" " " variable
" power
Head Phone
Loud Speaker
Jack 2 contact
" through
"
Battery
Polarity Signs + −
1 Contact switch
2 " "
Variable Battery connection
TALLY SHEET
ELECTRIC CIRCUIT DIAGRAMS
POPULAR MECHANICS
RADIO BROADCAST
SCIENTIFIC AMERICA
Ja. Fe. Mr. Ap. My. Ju. Jul. Au. Se. Oct Nov. De. Ja. Fe. Mr. Ap My Ju Jul. Au. Se. Oct Nov Dec. Ja. Fe. Mr. Ap. My Ju Jul. Au.
KEY
x- ADVERTISEMENT CONTAINING GIVEN ITEM
•- UNIT OF CONTENT " " "

Within each class the forms were tallied according to type and each form was analyzed into its elements: a separate tally was then kept of the occurrence of each element. In keeping with the purpose of the study, the analysis and classification were made entirely from the standpoint of comprehension. It is probable that a desirable analysis and classification from the standpoint of the construction of the forms would follow somewhat different lines. Such published lists of symbols as could be found were used as aids in analysis and classification. The following lists were employed for this purpose:

Mechanical and Architectural Drawing

French, T. E. and Svenson, C. L.: *Mechanical Drawing for High Schools*, McGraw-Hill Book Co., New York, 1919, p. 73 ff.

Mechanical, Architectural and Topographical Drawing

Miller, H. W.: *Mechanical Drafting*, The Manual Arts Press, Peoria, Ill., 1921, pp. 92, 201 ff.

Architectural Drawing and Electric Circuit Diagrams

Anthony, G. C.: *An Introduction to the Graphic Language*, Heath and Co., New York, 1922, pp. 5 165 ff.

Mechanical Drawing and Electric Circuit Diagrams

Schofield, H. E. and Others: *Mechanical Drawing for Junior High Schools*, Board of Public Education, Philadelphia, 1927, pp. 16, 18, 20.

Mechanical Drawing

Ketchum, S. and Committee American Standards Association: "Tentative Standards in Drafting Room Practice," *American Machine and Tool Record*, 53 W. Jackson Boulevard, Chicago, January, 1929, pp. 23–30.

Radio Circuit Diagrams

"List of Radio Symbols," *Radio News*, October, 1928, Experimenter Publishing Co., New York.

Graphs

Rugg, H.: *A Primer of Graphics and Statistics*, Houghton, Mifflin & Co., New York, 1925, p. 104 ff.

Brinton, W. C.: "Graphic Methods for Presenting Facts," The Engineering Magazine Co., New York, 1920.

The lines of distinction employed in classifying the graphic froms found by type and minor feature will probably not meet

with complete agreement. It would have been desirable to have had the lines of classification determined by a consensus of opinion of a number of competent judges in each of the respective fields but such a procedure was not feasible because of the manner in which it seemed best to conduct the survey. It appeared desirable in a first investigation in a new field, such as this, to start with a clean sheet and an open mind to record what might be found, without possible trammels of prejudgment or convention. As new forms were encountered there was not time or opportunity to seek a consensus of opinion of competent judges for their classification, and the investigator was forced to rely on his own, often rather hasty, judgment.

It would be desirable for any one planning a supplementary study in this field to submit the classification employed in this study to groups of competent judges for their judgment regarding its desirability.

Method of Tallying

It was the original intention to tally each feature as many times as it occurred within a given unit of subject matter but it was found that the significance of many subordinate features could not be indicated numerically. It would have been a simple matter to tally the number of lakes, islands, or location marks for cities, for instance, on a map as an index of their significance but quite impossible to indicate numerically the significance of a symbol for a shore line, for a mountain chain or for a political boundary line. In order to keep the tally of all features on the same basis, one tally was made for each feature found within a given unit of subject matter without respect to the number of times it was used within the unit. The unit of subject matter was in some cases an article, in others an advertisement, in others an isolated diagram or drawing.

Advertisements repeated without change in successive issues of the same magazine, whether in consecutive issues or at longer intervals, were tallied but once for the series. This procedure was based on the following considerations. It is to be presumed that a repeated advertisement possesses a higher probability of

being read attentively by constant readers of a periodical or of coming into the hands of a larger number of occasional readers than an advertisement appearing in but one issue. Tallying but once for the series of repetitions therefore would tend to undervalue its significance. On the other hand, with respect to a given reader an advertisement would ordinarily function but once in conveying information, irrespective of the number of repetitions, and tallies for each repetition would tend to overvalue its significance. This study does not concern itself with degrees of attention given by readers but solely with the need for comprehension presented by reading matter. In so far, then, as the successive issues of a periodical containing a repeated advertisement come into different hands the tally should be repeated; insofar as they come into the same hands the tally should be made but once.

It is to be presumed that repetitions of advertisements come into the same hands far more frequently than they come into different hands. Since the overvaluation in the former case by tallying for each repetition might run as high as 365 times for daily publications it was adjudged that one tally for a series of repetitions would, in general, introduce less error than separate tallies for each repetition or some arbitrary intermediate number of tallies.

Method of Conducting the Survey of Magazines

Since libraries make a practice of removing back numbers of magazines from their shelves for binding a short time after each volume is completed, during which process the advertisements are stripped off, and since a considerable number of the magazines could, conveniently, be seen only on friendly news stands it was necessary to survey the copies of the magazines soon after they appeared rather than to employ the more economical process of surveying them by volume or by the year.

The establishment of a comprehensive list of the graphic forms employed in the current reading matter of the non-specialist was given first consideration in the conduct of the survey and the determination of the frequency of occurrence secondary. Using

the principle of diminishing returns for determining the limits of the list, as already described, sub-lists six, five and four were selected tentatively as the field for the survey and all of the issues of the magazines on these lists for the year 1928 were surveyed as they appeared. It was assumed that if sub-lists five and four, taken together, made no significant additions to the forms found in sub-list six, or if sub-list four made no significant additions to those found in five and six, the zone of no additions would have been reached and the survey carried sufficiently far to be comprehensive. If sub-lists five and four successively made significant additions it would be necessary to carry the survey through sub-lists three, two and one in turn. If each of these in turn contributed significant additions it would be necessary to find some other means of solving the problem. As the survey was carried forward it became increasingly apparent that sub-list four would form the anticipated zone of no significant additions. Upon the conclusion of the survey of this list it was found that but two new types and twenty-six subordinate and associated features had been added; seventeen of the twenty-six subordinate and associated features were found in technical magazines alone and all of the items added were so low in frequency of occurrence and distribution as to be of little or no significance. It was assumed, therefore, that the survey had been carried far enough to be adequately comprehensive for the purposes of this study. The items added by sub-list four are indicated in the "Magazines—Total" columns of the tables of data on the inserts. The magazines surveyed are given in list 1, page 58.

Check on the Comprehensiveness of the Magazine Survey

The method of selecting magazines for the survey from the master list left it a conceivable matter that there might be some types of magazines read by non-specialists which were not represented on sub-lists six, five or four. To insure against omissions from such a possibility the 1070 publications of the master list were divided into sixty-one classes according to character of subject-matter or class appeal. For this purpose

the list of forty-four subdivisions of "General Magazines" found in the Standard Rate and Data Service (3) was taken as a basis and modified to suit the purpose of the study; four subdivisions such as "mail order" which were evidently made in the interest of advertisers or were otherwise inappropriate to the purpose, were omitted and seventeen others added which it was thought might possibly contain new graphic forms. This list, with the modifications indicated, forms List 2, page 61. The various classes were then examined to see whether they were represented in sub-list six to four. Nineteen classes, as noted in List 2 were not represented; representative issues of these were examined but in no case was any new form found. Since this phase of the investigation was solely for confirmatory purposes and since no new forms were discovered it was deemed unnecessary to analyze and tally the forms found. The confirmatory purpose was held to justify also the empirical manner in which, in the absence of a more objectively determined list of classes, the list was formulated.

Daily Newspapers

Since newspapers are regional in circulation the most effective method of securing a comprehensive list of the graphic forms used in them, seemed to be that of making a complete survey of all of the principal newspapers in one region, and then to check the comprehensiveness of the returns by samplings from other regions, rather than to select a sample newspaper from each of various regions. This procedure was followed, all of the issues of all of the Philadelphia daily newspapers printed in English were surveyed and the graphic forms found in them were classified, analyzed and tabulated as described for magazines, separate tabulations being made of forms found in content and in advertisements.

List of Newspapers Surveyed

Public Ledger, daily and Sunday
Inquirer, daily and Sunday

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[3] *Op. Cit.*

Record, daily and Sunday
Daily News (tabloid) daily (except Sunday)
Evening Bulletin daily (except Sunday)
Evening Public Ledger daily (except Sunday)

To check the comprehensiveness of the list of graphic forms secured from the Philadelphia newspapers the following newspapers were selected from other geographic regions of the United States and a sampling survey made of their contents.

New York Times, daily and Sunday
Chicago Tribune, daily and Sunday
New Orleans Times-Picayune, daily and Sunday
Denver Rocky Mountain News, daily and Sunday
Los Angeles Times, daily and Sunday

Since the only significant variation in the use of graphic forms found in the Philadelphia newspapers was a slight seasonal one, such as the employment of floor plans of houses in real estate advertisements in seasons of real estate activity, and since the process of surveying and recording was a laborious one, it was deemed sufficient for checking purposes to survey the issues of one month in each of the four seasons, supplementing this with a more extensive survey if the discovery of additional forms warranted it. Since the seasonal sampling revealed no new forms the survey was not extended beyond the four months' issues.

The months chosen for the sampling were January, April, July and October. The findings were classified, analyzed and tallied as described for magazines and a record included in the original data of this study on file in the library of the University of Pennsylvania. Since the results were purely confirmatory, it was deemed unnecessary to cumber this report of the study with them.

Automobile Instruction Manuals

Instruction books for the 1928 models of the automobiles manufactured in the United States were surveyed and the contents analyzed and tabulated as described for magazines. The number of cars sold for the year 1928 was used as an index of the number of copies of instruction books placed in users' hands. The annual sale figures were smoothed to thousands which

automatically eliminated those of which less than 500 were sold during the year. One other, the Falcon-Knight, was omitted because the instruction manual could not be obtained. This omission can have had no significant effect on the returns since but 5000 of the 3,132,000 (1-630) automobiles sold in 1928 were Falcon-Knights. The forms found were analyzed and tabulated as described for magazines.

List of Automobile Instruction Manuals Surveyed

Auburn	Essex	Lincoln	Plymouth
Buick	Elcar	Locomobile	Pontiac
Cadillac	Ford	Marmon	Reo
Chandler	Franklin	Moon	Star
Chevrolet	Gardner	Nash	Stearns-Knight
Chrysler	Graham-Paige	Oakland	Studebaker
De Soto	Hudson	Oldsmobile	Stutz
Dodge	Hupmobile	Packard	Velie
Durant	Jordan	Peerless	Whippet
Erskine	LaSalle	Pierce-Arrow	Willys-Knight

Tabulation of Data

Upon completion of the survey the data accumulated were transferred to tabulation sheets (see sample). Key strips were made for the tabulation sheets with the items classified as "types", "subordinate features" and "associated features". "Types" are subdivisions of the five major divisions; "subordinate features" are details of the types; "associated features" are conventions added to convey some related information without being an integral part of the type. The line between subordinate feature and associated feature is at times indefinite and the distinction is of questionable value, although it was thought at the time it was made that it might be of some significance. The items on the tabulation key strips were rearranged in a more logical order than on the tally key strips, where they were listed in the order in which they were found. Column "F" (frequency) of the tabulation sheet (see sample) shows the total

KEY TO TABULATION SHEET

TABULATION SHEET

MECHANICAL DRAWINGS – MAGAZINES, LIST 4 - CONTENT

$\Sigma IC \div 1000 = 170,374$
Total List 4

MECHANICAL DRAWINGS TYPES	American Childhood C - 20,000		American City C - 15,000		American Girl C - 53,000		American Machinist C - 17,000		Annals Amer. Acad. C - 10,000		Woman's Journal C - 20,000		Frequency Index List 4		Coefficient of Distribution	Rank Index List 4
	N	I	N	I	N	I	N	I	N	I	N	I	ΣNC ÷ 1000	ΣIC ÷ 1000	ΣIC Item / ΣIC total	FI × CD · 1000
½ view, 2 dimensioned, symetrical													1481	1481	.008693	12870.
1 " " " with dimensions			4	2	5	5	15	15					18972	16730	.098196	1863000.
1 " 3 " " "							3	3					4156	4156	.02439	101400.
Isometric drawing							4	4					2861	2861	.01679	48036.
Cabinet "																
2 view, views not projected			1	1			5	5					1621	1353	.007941	12870
Phantom Section													134	134	.000787	1051
Half Section, symetrical			2	2			5	5								
Revoled section							1	1								
Section on line of plan			2	2			20	17								
Vertical section			18	11			3	3								
Section contours of boat hull																
Section of light rays																
Wave section																
Partial section							18	18								
Radiograph																
SUBORDINATE FEATURES																
Symbols for Materials - Wood -							8	8								
" " " - Iron or steel																
" " " - Cast Iron																
" " " - Iron							71	41								

KEY TO SYMBOLS

N - NUMBER OF UNITS OF SUBJECT MATTER CONTAINING A GIVEN ITEM.

I - NUMBER OF ISSUES CONTAINING A GIVEN ITEM.

C - AVERAGE CIRCULATION PER ISSUE.

FI - FREQUENCY INDEX

CD - COEFFICIENT OF DISTRIBUTION

RI - RANK INDEX

number of units of subject matter containing a given item in all of the issues of the year of each periodical;* column "I" (issues) shows the number of issues of the periodical in which the item appeared. The data from magazines were distributed on tabulation sheets for purposes of comparison according to the following classification; content and advertisement, sub-lists 6, 5, and 4, technical and non-technical magazines, juvenile magazines, womens' magazines. The classification used for the data from newspapers was "content" and "advertisements".

Calculation of Numerical Indices

It is apparent that the mere presence of a graphic form in a periodical would in itself be of no significance for curriculum construction since it might occur merely in a single issue of an obscure periodical of insignificant circulation. At least two factors function in the significance of a form from this standpoint, the frequency of occurrence and the extent of distribution; in general, the more frequently a given form occurs the more important that it be adequately comprehended by the reader. However, it is quite possible for a given form to have a high frequency by its frequently repeated occurrence in the periodicals of a single narrow class and thereby to appear more significant than a form in much more general use. This situation was found, for instance, in features of electric circuit diagrams appearing in radio magazines. To indicate the frequency significance and the extent of distribution of the forms found the "frequency index" and the "coefficient of distribution" have been employed.

The Frequency Index

The frequency index represents the aggregate circulation of all the units of subject matter in which a given form was found. It was calculated by multiplying the number of the units of subject matter which contained a given form in the year's

* For simplicity of language the word "periodical" is used in this study to include magazines, newspapers and automobile instruction manuals.

issues of each publication (the numbers in column "F" of the tabulation sheet) by the average circulation per issue of that publication (the number "C" in the headings of the tabulation sheet) and adding together all of the products so obtained for each item.

Mathematical formula: F. I. $=\Sigma FC$

F. I.—*f*requency *i*ndex

F—number of units of subject matter containing a given form

C — average circulation per issue of a given magazine

The circulation figures were smoothed to thousands, since the average figures do not warrant greater accuracy and the frequency indices were calculated to the number of significant digits occurring in the circulation figures. The frequency indices were tabulated on the tabulation sheets with the three right-hand zeros omitted for convenience and to save space.

The Coefficient of Distribution *

The coefficient of distribution represents the decimal fraction of the total number of copies of all periodicals on a given list in which the particular item was found. It was calculated by multiplying the number of issues of each periodical which contained the given form (the figures in column I of the tabulation sheet) by the average circulation per issue (figure C in the headings of the tabulation sheet) and adding all of the products so obtained for each item; this sum was then divided by the aggregate annual circulation of all of the issues of all of the periodicals on the list.

Mathematical formula: $C.D. = \frac{\Sigma IC \text{ item}}{\Sigma IC \text{ total}}$

C.D.—coefficient of distribution

I—number of issues

C—average circulation per issue of a given periodical

It is to be noted that the maximum value of the coefficient of distribution is unity and that this value obtains when every issue of the periodicals on the list involved contains the given form.

It would have been desirable to base the calculation of the coefficient of distribution on the same unit as that of the fre-

quency index—the unit of subject matter—but this proved not to be feasible because of the impossibility of determining with any degree of accuracy the denominator of the formula—the possible number of units of subject matter in which the graphic form might have been used. The only effect of using the issue as the unit of calulation is that of smoothing the resulting coefficients.

The Rank Index

In comparing the relative significance of the various items, and in ranking them for presentation in this report, it was necessary to combine the frequency significance of each item with its distribution significance. Since no valid method of making these two factors commensurable could be discovered the most satisfactory procedure seemed to be to combine them into a simple product, thus producing a number which would be directly proportional to each. This product is termed the "Rank Index" of the item. It was obtained by multiplying the frequency index of each item by its coefficient of distribution.

Mathematical formula: $R.I. = F.I. \times C.D.$

R. I—rank index

F. I.—frequency index

C. D.—coefficient of distribution

It must be remembered in the interpretation of the rank index that it is a pure number which indicates only the relative significance of items calculated on the same basis. It can be thought of most effectively, probably, as the frequency index of an item weighted negatively in proportion to its lack of distribution.

The frequency index, the coefficient of distribution and the rank index, together with the ΣIC for each item (used in the calculation of the coefficient of distribution) were tabulated on the right side of each tabulation sheet, as shown on the sample. The "thousand" by which each frequency index was reduced for convenience on the tabulation sheets was restored in the rank index.

Method Used to Combine Data from the Three Sources

The data included in this study have been secured from three

different sources; magazines, newspapers and automobile instruction manuals, and the three indices devised to give numerical significance to the forms found were calculated for each item as found in each of the three sources, as described under "procedure". These indices are given in the tables of data on the two inserts. When it came to the point of summarizing the results of the study a fresh difficulty arose. To be usable the three sets of indices from the three sources of material must be combined into a single set and yet the results could not with justification be directly combined because the selection of material to be surveyed from each source was made on a different basis; magazines according to prominence and popularity, as indicated by frequency of appearance in the component lists of the master list; newspapers territorially, those published in Philadelphia; automobile instruction manuals temporally, those of the year 1928. Before combining it was necessary to so modify the three sets of data that they would represent comparable fractions of comparable totals. After considerable investigation it became apparent that information necessary for entirely satisfactory combination was not available and the method finally employed was selected as the least objectionable of those available rather than because of inherent merit.

The method used was to make the data from the three sources represent equal fractions of the national circulation of the respective sources by taking the set of data from one source as a base and multiplying the other two sets by the coefficients necessary to make them the same fractions of their respective national circulations as the first set; the three sets of data were then combined by summation.

Consideration was given to the question of multiplying each set of data by a coefficient sufficiently large to make it equivalent to the total national circulation of its source but this procedure was abandoned because it would have introduced the implication that the surveyed material was adequately representative of the unsurveyed material and there are reasons for believing that such is not the case. Magazines beyond those surveyed tend rapidly to become more specialized in character and much smaller in circulation; the newspapers of small circulation en-

countered in the course of the study, notably those below 50,000 per issue, made little or no use of graphic forms, presumably because of the difficulty and expense of making cuts; recent automobile instruction manuals, judging from the comparison of a limited number of samples of past years with those of the survey, are tending to use conventionalized line drawings less, substituting for them more easily interpreted shaded forms, such as shaded sections and phantom drawings.

Method of Calculating Coefficients Used to Combine Data

The coefficients used in combining the data from the three types of source material, magazines, newspapers and automobile instruction manuals, were determined as follows: The total annual circulation for continental United States of each type of material was divided into the total annual circulation of the surveyed portion of that type. Then, taking magazine material as a base, because the fraction of magazines surveyed was the largest and the returns the most extensive, a coefficient of one was arbitrarily assigned to magazine material and the coefficients required to make the surveyed portions of the other two types of material the same fractions of their totals were calculated. Because of the crudity of the figures entering into the calculation, coefficients were smoothed to the nearest single integer and only a sufficient number of significant digits was carried in the contributing figures to yield this one.

Details of the calculation follow:

	TOTAL ANNUAL CIRCULATION (smoothed to three digits)	FRACTION OF CIRCULATION SURVEYED	COEFFICIENT TO EQUALIZE DATA	COEFFICIENT SMOOTHED TO NEAREST INTEGER
All magazines surveyed	742,000,000	.21		1
All magazines in U.S. (est)	3,530,000,000			(assumed)
All newspapers surveyed	514,000,000	.039	$\frac{.21}{.039}=5.4$	5
All newspapers in U.S.	13,300,000,000			
New automobiles sold in 1928	3,130,000	.15	$\frac{.21}{.15}=1.4$	1
All automobiles in U.S. in 1928	21,000,000			

Since the magazines surveyed are presumably more representative of the master list from which they were selected than of the magazines of the United States as a whole, and since the Philadelphia newspapers are presumably more representative of newspapers having a daily circulation of 100,000 or more, within which class they fall, than of newspapers in general, as a matter of interest the coefficients necessary to equalize the data on these two bases were determined. The details of the calculation of these coefficients follow:

	TOTAL ANNUAL CIRCULATION smoothed to three digits)	FRACTION OF CIRCULATION SURVEYED	COEFFICIENT TO EQUALIZE DATA	COEFFICIENT SMOOTHED TO NEAREST INTEGER
All magazines surveyed All magazines on master list	$\frac{742,000,000}{2,090,000,000}$	.36		1 (assumed)
All newspapers surveyed All newspapers of 100,000c.	$\frac{514,000,000}{6,560,000,000}$	.078	$\frac{.36}{.078}=4.6$	5

It seems worthy of note that the coefficients for newspapers calculated on the two bases are the same since this tends to confirm the reliability of the coefficient.

The coefficients as calculated above were used to combine the three sets of data into the single set given under the heading "Combined Data" of the Tables of Data on the inserts; *i. e.*, the figures yielded by the findings in magazines and automobile instruction manuals were combined without change and the figures for newspapers were each multiplied by five before combination.

Sources of Circulation Figures

The circulation figures for magazines used in this study were obtained from the following sources, figures not given in one source being, at times, found in one of the others. The Standard Rate and Data Service, Chicago, Ill., The American Newspaper Annual and Directory, published by N. W. Ayer & Son, Phil-

adelphia, The Pocket Directory of the American Press, published by Lord, Thomas & Logan, Chicago, Ill., a few circulation figures not given in the above sources were obtained from the private files of the Charles Blum Advertising Corp., Phila., through the courtesy of Mr. Charles Blum, President. Figures for the following magazines were furnished by the publishers upon request: *American Childhood*, *Musical America*, *The Musician*, *New Republic*, *North American Review*. Circulation figures for the balance could not be obtained directly and had to be estimated. Missing figures could not justifiably be calculated by any method of averaging those given becuase circulation figures are given out primarily for the benefit of advertisers and the chief reason for withholding them is presumably their relative smallness. Calculation of missing figures from an average of those given would therefore tend to give estimates much too large. Missing figures were estimated individually from others of similar type as indicated by nature of content, subscription price, number of issues per year, place of publication and probable territory of circulation with some weight given to the fact that the figures had been withheld by the publisher and that the probable reason for this was undue smallness within their class. In the selection of magazines which could be considered as similar from the standpoint of circulation, the highly subdivided list of classes given in the *American Newspaper Annual*, containing six major and 777 minor headings, was used to advantage. While this method of estimating is in considerable degree subjective it was found that in most cases a fair basis for inferring the approximate circulation was afforded because the missing figures were largely among magazines of special classes with characteristically, or necessarily, small circulation. Only five of the publications for which figures had to be estimated fell among those surveyed; these are indicated by an asterisk after the circulation figures in List 1. Estimated circulation figures for other magazines enter the study only as they are included in aggregate circulation figures, chance errors, therefore, tend to cancel out and to make the aggregate appreciably more reliable than the specific estimates. The degree to which estimate entered into the aggregate figures is shown in tables 1 and 2. Table 1 shows

TABLE 1

ANNUAL CIRCULATION OF ISSUES OF MAGAZINES ON MASTER LIST—BY SUB-LISTS

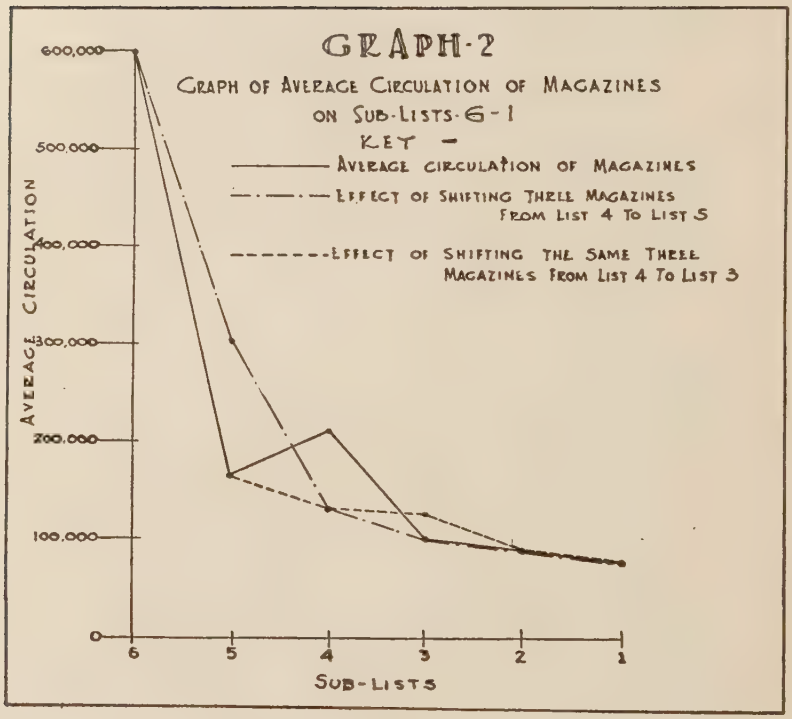
	Issues			Circulation		
	GIVEN	ESTIMATED	TOTAL	GIVEN	ESTIMATED	TOTAL
List 6	853	0	853	508,022,000 aver. 596,000	0	508,022,000 596,000
List 5	393	0	393	63,950,000 aver. 163,000	0	63,950,000 163,000
List 4	713	100 (12%)	813	159,254,000 aver. 223,000	11,120,000 (7%) 111,000	170,374,000 210,000
List 3	1,702	226 (12%)	1,928	184,602,000 aver. 108,000	12,920,000 (7%) 57,000	197,522,000 102,000
List 2	2,846	811 (22%)	3,657	269,349,000 aver. 95,000	58,234,000 (18%) 72,000	327,583,000 90,000
List 1	8,496	2,952 (26%)	11,448	734,729,000 aver. 86,000	84,542,000 (10%) 29,000	819,271,000 72,000
Total	15,003	4,089 (21%)	19,092	1,919,906,000 aver. 128,000	166,816,000 (8%) 41,000	2,086,722,000 109,000

TABLE 2

ANNUAL CIRCULATION OF ISSUES OF ALL UNITED STATES MAGAZINES

Based on Figures Given in the American Newspaper Annual and Directory for 1929, N. W. Ayer & Son, Phila., Pa.

	Issues			Circulation		
Ayer's Classification	Given	Estimated	Total	Given	Estimated	Total
Agricultural	278	3,150 (31%)	10,428	455,123,000 aver. 63,000	13,892,000 (3%) 4,000	469,015,000 45,000
Collegiate	26,067	5,853 (18%)	31,920	63,652,000 aver. 2,000	5,306,000 (8%) 1,000	68,958,000 2,000
Fraternal	1,570	1,396 (47%)	2,966	79,358,000 aver. 51,000	9,280,000 (10%) 7,000	88,638,000 30,000
General	4,589	961 (17%)	5,550	1,573,046,000 aver. 343,000	31,581,000 (2%) 33,000	1,604,627,000 289,000
Religious	11,424	6,146 (35%)	17,570	255,132,000 aver. 22,000	55,418,000 (18%) 9,000	310,550,000 18,000
TradeTech.andClass	63,204	48,973 (44%)	112,177	735,323,000 aver. 12,000	249,197,000 (23%) 5,000	984,520,000 9,000
Total	114,132	66,479 (37%)	180,611	3,161,634,000 aver. 28,000	364,674,000 (10%) 5,000	3,526,308,000 20,000


GRAPH-2
GRAPH OF AVERAGE CIRCULATION OF MAGAZINES
ON SUB-LISTS-6-1
KEY -
AVERAGE CIRCULATION OF MAGAZINES
EFFECT OF SHIFTING THREE MAGAZINES FROM LIST 4 TO LIST 5
EFFECT OF SHIFTING THE SAME THREE MAGAZINES FROM LIST 4 TO LIST 3
AVERAGE CIRCULATION
600,000
500,000
400,000
300,000
200,000
100,000
0
6
5
4
3
2
1
SUB-LISTS

the number and the percentage of issues on the master list and sub-lists for which circulation figures were estimated, the aggregate and percentage circulation estimated and the average circulation for master and sub-lists. It is to be noted that the percentage of the total annual circulation which was estimated, is little more than one-third of the percentage of issues (8 per cent as compared with 21 per cent) and that the percentage of issues for which the circulation was estimated progressively increases from list four to list one, being zero for lists six and five. This indicates that the magazines for which circulation figures were not furnished tended to be among those least representative and of small circulation.

Some contributory evidence which supports the method employed in this study of obtaining the most representative magazines is afforded by the average circulation figures of the sub-lists. If magazines were arranged in order according to their true degree of representativeness, it would seem to be inevitable that average circulation figures would become progressively smaller as one proceeded outward from the most representative to progressively less representative groups. This condition is exhibited in the main by the average circulation figures of the sub-lists, see graph 2. There is an apparent exception in list four but investigation showed that a shift of the three magazines having the highest circulation in list four

	AVERAGE CIRCULATION PER ISSUE
McCall's Magazine	2,307,000
Cosmopolitan	1,706,000
Country Gentleman	1,622,000

to list five would change the graph to the shape shown by the dot and dash line while a shift of the same three magazines to list three would produce the change represented by the dotted line. Since the irregularity in the curve was removed by a shift of three magazines in either direction, the implication is that the irregularity was due to chance factors operating in the formation of list four.

Table 2 shows the amount and percentage of estimate for each

of the six major divisions of Ayer's[4] classification and for the total magazine circulation in continental United States.

Circulation figures for newspapers were obtained from The Standard Rate and Data Service and the American Newspaper Annual and Directory. Since circulation figures were found for all newspapers no need for estimating such as that encountered with magazines was experienced.

Annual sale figures for the United States of the various makes of automobiles were taken as the index of the circulation figures of automobile manuals for the year 1928. These were obtained from *Motor Magazine* for March, 1929 (published by International Magazine Co., N. Y), where it is stated that figures were supplied by the R. L. Polk & Co., Detroit, Mich.

Calculation of Aggregate Annual Circulation Figures for Continental United States Newspapers

Since the aggregate annual circulation figures for newspapers of continental United States could not be obtained directly, they were obtained by taking the aggregate daily circulation figures given in the *American Newspaper Annual and Directory* for the newspapers of the United States and Possessions and Canada, multiplying the daily and Sunday circulation figures respectively by 314 and 52 to get the aggregate annual circulation and subtracting from the results so obtained corresponding figures for the outlying possessions of the United States and for Canada, calculated from circulation figures of the individual papers as given in the *Annual.*

Magazines

The aggregate annual circulation figures for magazines were calculated from the list of magazines given in the *American Newspaper Annual and Directory*, a total of 6794 publications, The statement in the *Annual* was accepted that it lists all magazines of any consequence published in the United States. The

[4] *Op. Cit.*

circulation figure of each magazine given, or estimated as already described, was multiplied by the number of issues per year and the products summed to give the aggregate annual circulation. Magazines printed in foreign languages were omitted from the count on the ground that they were presumably not representative of conventional usage in the United States. Foreign magazines printed in English were also omitted because no way was discovered by which their circulation in the United States could be determined and their influence on the total was allowed to offset that of the foreign circulation of United States magazines.

Automobile Instruction Manuals

The problem of estimating the total number of automobile manuals in active use is significantly different from that of periodicals because the manuals are subject to use during the life of the car whereas the main use of periodicals is concentrated within a short period of time after their publication. As the best available index of the total number of automobile manuals in use the total number of automobiles in the United States as derived from figures given in the 1929 World Almanac (New York)—21,000,000 was taken. Since this figure makes no allowance for the number of manuals lost or destroyed and not replaced, or the number of manuals never used by car owners, it is not a very reliable index. Its reliability is rendered of little consequence, however, by the insignificant degree to which returns from manuals affect the total figures.

Results of the Survey

Summary of Data

Table 3 gives a summary of the data furnished by the survey in terms of the five major types of graphic forms found. The roughness of the approximations entering into the calculations warrants only one significant figure in the rank index, therefore only a sufficient number of significant digits was carried in the contributing figures to yield that one To give an indication of

TABLE 3

GENERAL SUMMARY OF DATA

	Separate Data			Combined Data		
	MAGAZINES FREQ. INDEX	NEWSPAPERS FREQ. INDEX (weight 5x)	AUTO MANUALS FREQ. INDEX	FREQUENCY INDEX	COEF. OF DISTRIBUTION	RANK INDEX
Maps	550,000,000	1,700,000,000	860,000	2,200,000,000	.52	1,000,000,000
Mechanical Drawings	810,000,000	340,000,000	15,000,000	1,200,000,000	.17	200,000,000
Graphs	210,000,000	630,000,000		840,000,000	.17	100,000,000
Architectural Drawings	230,000,000	280,000,000		510,000,000	.11	60,000,000
Electric Circuit Diagrams	78,000,000	75,000,000	3,000,000	160,000,000	.030	5,000,000

the degree to which each type of reading matter contributes to the combined figures the frequency indices for each of the three sources, magazines, newspapers and automobile instruction manuals are given, the frequency index of the combined data being the simple sum of the indices for the three sources.

Interpretation of Indices

It must be borne in mind by those using the data of this study that coefficients of distribution, being ratios, can not be combined by addition. Each must be calculated from the raw data according to the fomula:

$$C.D. = \frac{\Sigma IC \text{ item}}{\Sigma IC \text{ total}}$$

C.D.—coefficient of distribution
I —issues per year
C —average circulation per issue

Since the coefficient of distribution enters into the calculation of the rank index, formula

$$R.I. = F.I. \times C.D.$$

R.I.—rank index
F. I.—frequency index
C.D.—coefficient of distribution

rank indices, also, cannot be combined by addition and can be legitimately compared only when calculated from coefficients of distribution having the same denominator.

The figures of the General Summary, Table 3, are to be interpreted in the following manner.

Frequency Index and Coefficient of Distribution

Maps.—In a survey of the most representative fifth of the copies of all of the magazines, newspapers and automobile instruction manuals issued in the United States during the year 1928 approximately 2,200,000,000 (frequency index of combined data) units of subject matter containing some form of map were found. About three-quarters of this number

$$\frac{1{,}700{,}000{,}000 \text{ (frequency index for newspapers)}}{2{,}200{,}000{,}000 \text{ (frequency index for combined data)}}$$

were found in newspapers, about one quarter,

550,000,000 (frequency index for magazines)
2,200,000,000 (frequency index for combined data)

in magazines and one four-thousandth,

860,000 (frequency index for automobile instruction manuals)
2,200,000,000 (frequency index for combined data)

in automobile instruction manuals, slightly over one-half of all the issues contained at least one map in either content or advertisements (coefficient of distribution, .52).

Mechanical Drawings—"In a survey of the most representative fifth of the copies of all of the magazines, newspapers and automobile manuals issued in the United States during the year 1928 approximately 1,200,000,000 (frequency index for combined samplings) units of subject matter containing some form of mechanical drawing were found. About two-thirds of these,

810,000,000 (frequency index for magazines)
1,200,000,000 (frequency index for combined samplings)

were found in magazines, one quarter,

340,000,000 (frequency index for newspapers)
1,200,000,000 (frequency index for combined samplings)

in newspapers and one-eightieth

15,000,000 (frequency index for automobile manuals)
1,200,000,000 (frequency index for combined samplings)

in automobile manuals. About one-sixth of the issues (coefficient of distribution .17) contained at least one drawing in either content or advertisement. (It must be borne in mind that the definition of mechanical drawing used in this study is much broader than that in conventional use, see p. 45.)

Figures for graphs, architectural drawings and electric circuit diagrams are to be interpreted similarly.

Rank Index

When the figures for frequency of occurrence and for distribution are combined by multiplication so that the various types of graphic form can be ranked according to the combined effect of these two factors the "rank index" is obtained, as already explained. The rank index for maps in the most representative

fifth of all of the magazines, newspapers and automobile manuals issued in the United States in 1928 is 1,000,000,000; this is five times as large as the rank index for mechanical drawings, ten times as large as that for graphs, nearly seventeen times as large as that for architectural drawings and two hundred times as large as that for electric circuit diagrams.

Detailed Tabulation of Data

The Tables of Data on the inserts give the three indices for types, subordinate features, and associated features, respectively, of the five major divisions of the classification, maps, mechanical drawings, graphs, architectural drawings, and electric circuit diagrams. The tremendous range in the numerical significance of the various items will be more apparent when it is realized that a graph which would show the smallest rank index, .02 (DS50) as 1-50 of an inch (scale, rank index 1. = 1″) would have to be 6313 miles long to show the largest individual rank index, 400,000,000 (MTI), and 15,784 miles long to show the largest aggregate rank index, 1,000,000,000 (maps, all types). In order that the figures on these lists may be somewhat more intelligible the following indices have been computed for comparison:

TABLE 4

COMPARISON INDICES

AVERAGE OCCURRENCE IN THE READING MATTER OF AN INDIVIDUAL	FREQUENCY INDEX	COEFFICIENT OF DISTRIBUTION	RANK INDEX
One hundred times per year	1,630,000,000	.48	800,000,000
Ten times per year	163,000,000	.048	8,000,000
Once per year	16,300,000	.0048	80,000
Once in ten years	1,630,000	.00048	800
Even chances of once in a lifetime (50-year span)	163,000	.000048	8

Method of Computation of Comparison Indices

The total number of copies of magazines, newspapers and automobile manuals issued in the United States during the year 1928 is estimated by the method already described to be 16,-

900,000 000. The total number of inhabitants in the United States fifteen years of age and over in 1928, according to an estimate of the United States Census Bureau (cf. World Almanac, New York, 1929, pp. 283, 298) was 81,600,000. This gives an average of 207 copies per year per individual fifteen years of age and over. On this basis a graphic form appearing in one-207th of the issues would, if uniformly distributed, appear in the periodical literature of the average reader once per year. One appearance in 207 issues yields a coefficient of distribution of .0048. Correspondingly, a coefficient of distribution of .048 would indicate an appearance ten times per year per individual, .48 an appearance one hundred times per year and .00048 once in ten years.

The minimum frequency index for an average appearance once per year per individual in the total periodical literature of the country would be 81,600,000; for the fifth of the total represented by the combined data this figure would be reduced to one-fifth its size or 16,300,000; for ten appearances per year the frequency index for the combined data would accordingly be 163,000,000; for one hundred appearances per year, 1,630,000,-000, for one appearance in ten years, 1,630,000. For a more extreme estimate to compare with the smaller indices the following computation was made. The American Experience Table (see 1929 World Almanac p. 306) gives an average life of approximately 65 years to those fifteen years of age or over, that is, an average continuance of life of fifty years. Even chances of meeting a given graphic form during this fifty years would be represented by a frequency index and a coefficient of distribution one-hundredth the size of those representing an average certainty of once per year, or a frequency index of 163,000 and a coefficient of distribution of .000048. These, multiplied, yield a rank index of 8.

On the above basis the figures given in the general summary (table 3) would be interpreted as follows:—"The periodical literature of the United States, if it were all like the twenty per cent sampling of this study, if uniformly distributed throughout the population fifteen years of age and over, and if each copy remained in the hands of the first possessor, would place in the

hands of each reader during the year a total of 207 copies, of which 108 would contain 135 maps of some sort.

35 would contain 74 mechanical drawings of some sort.

35 would contain 51 graphs of some sort.

23 would contain 31 architectural drawings of some sort.

6 would contain 10 electric circuit diagrams of some sort."

	AVERAGE ISSUES PER INDIVID. X COEF. OF DIST.	FREQUENCY INDEX / 1/5 OF POPULATION
Maps	207 X .52 = 108	$\frac{2,200,000,000}{16,300,000} = 135$
Mechanical drawings	207 X .17 = 35	$\frac{1,200,000,000}{16,300,000} = 74$
Graphs	207 X .17 = 35	$\frac{840,000,000}{16,300,000} = 51$
Architectural drawings	207 X .11 = 23	$\frac{510,000,000}{16,300,000} = 31$
Electric circuit diagrams	207 X .03 = 60	$\frac{160,000,000}{16,300,000} = 10$

The comparison indices have been entered in the appropriate places among the indices of the Tables of Data on the inserts, as an aid to their interpretation but it must be remembered that they are based on reasoning from averages and that their legitimate use is purely one of suggestion. It seems probable that a significant number of periodicals are read by more than one person, notably in libraries and in families, and that adults who have had a high school education make a significantly greater use of periodicals than the national average. Both of these influences would tend to make the above estimates too small for determining courses of instruction for high schools. There are unquestionably great regional differences in reading

habits which should also be taken into account; Stone[5] found in 1928 that the average number of inhabitants per copy of daily newspapers varied among the states from 1.68 to 18.11 and in 1924 that the average number of inhabitants per copy of forty-seven leading magazines varied among the states from 1.84 to 12.49.

More exact evaluation of the results of this study must therefore await reliable determination of the reading habits of the people of the United States. The several studies thus far made regarding habits have been summarized by Gray and Munroe[6] but none is sufficiently extensive either in respect to number of individuals, territory covered or extensiveness of information included to be of value for the present purpose.

Notes on the Method of Classification and Analysis

The illustrations furnished on plates 1 to 13 afford the most important aid to an understanding of the nature of the items of classification but some supplementary explanation is also called for regarding certain of the items in order that the basis of classification may be clearly understood.

Maps

Outline maps (MT1) are line maps with few or no details. The distinction between line and outline maps is one of degree and there is an intermediate zone in which classification is arbitrary. Information as to the frequency of the details is afforded by the numerical indices of subordinate and associated features.

Colored or shaded area maps (MT5) use one of these methods in addition to lines to distinguish different regions.

Street maps (MT3) are distinguished from city maps by the fact that they show only a portion, usually rectangular, of a city or town.

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[5] Stone Orlando, "Does North Carolina Read?" University of North Carolina News Letter XI, April 15, 22, 29, May 6, 20, 1929.
See also Gray, William S. and Munroe, Ruth, *The Reading Interests and Habits of Adults*, pp. 14 and 18, The Macmillan Co., New York., 1929

[6] *Op. Cit.*

Relief maps (MT7) show differences in land evel by shading.

Pictorial maps (MT6) have miniature pictures inset at appropriate points to vitalize them.

Profile maps (MT10) show the outline of the land projected on a vertical plane, while geologic sections (MT11) add stratification to this outline.

Mechanical Drawings

In considering mechanical drawings it is important to remember that there are two distinct purposes for which they are employed; (a) to convey information needed for the construction of the machine; (b) to convey information regarding the nature, operation or use of the machine. It is conventional to include under the term "mechanical drawing" only those for the first purpose. This arbitrary distinction is not appropriate to the purpose of the present survey, hence the term is applied indiscriminately to drawings used for either purpose. Several types of drawing are used for both purposes, the main distinction being the dimensioning of construction drawings, but certain types are adapted only to purpose (b), notably shaded sections, cutaway sections and phantom drawings and sections. It is to be expected that mechanical drawings found in periodicals, even in technical periodicals, would consist mainly of the second class, and the returns confirm this.

Under "one view, three dimensioned drawings" (DT10) are included only drawings of this character which did not conform to the conventions of isometric or oblique projection.

Shaded sections (DT5) are section drawings which show curvature of surface and other details by degrees of light and shade.

In cutaway sections (DT1) a portion of the exterior is shown as though it were removed to display the details of the interior.

Phantom drawings (DT7) show the exterior surface in light, the interior in dark shades, as though the object were rendered transparent.

Phantom sections (DT19) are sections shown on line drawings in dotted lines.

Line sections (DT2,DT8,DT9) (contrast with shaded sections) are of widely different degrees of complexity. To give some indication of the degree of complexity they were divided into three classes, plain sections (DT2), sections with two adjacent surfaces (DT8) and sections with three adjacent surfaces (DT9), under the assumption that the greater the number of adjacent surfaces the more difficult the interpretation.

Radiographs (DT21) are X-Ray photographs. They partake somewhat of the nature of phantom drawings.

Architectural Drawings

Under "plan of arrangement of objects" (AT2) were listed architectural or similar plan views which were not plan views of floors of buildings.

Electric Circuit Diagrams

Nearly all of the electric circuit diagrams found were radio diagrams. With the advent of the light socket radio set the distinction between radio and other forms of electric circuit diagrams loses most of its significance since radio diagrams frequently include symbols for electric light and power, bell wiring and telephone apparatus; therefore no subdivision of the circuits into types was attempted. There seemed also to be no sufficient reason for separating minor features into "subordinate" and "associated features"; all are classed, therefore, as "subordinate features."

Graphs

Line-bar graphs (GT2) are graphs in which the length of the bars indicates the relative sizes of the units and the imaginary line along which the bars are centered represents the trend of the series of units. In GT37 the line of averages is a real, instead of an imaginary, line.

Pictogram, line (GT17), pictogram, area (GT9), and pictogram, volume (GT23) represent the compared magnitudes respectively by corresponding linear dimensions, areas and volumes of similar pictures.

Area graph, rectangles (GT13), area graph, concentric circles (GT21), circular area graph (GT22), area graph, adjacent circles (GT36), and sectored circle graphs (GT11 and GT12), represent the magnitudes to be compared by similar areas instead of by linear dimensions as in line and bar graphs.

It is believed that the nature of the types not commented upon will be readily apparent from the illustrations furnished.

Graphic Forms Found in Advertising Matter

The effectiveness of advertising matter is obviously dependent upon its comprehensibility to the persons to whom it is directed. Advertising copy writers must be conscious of this and, in consequence, employ more than usual care in making copy understandable. This gives an added significance to the graphic forms employed in advertisements which was deemed of sufficient importance to warrant reporting the findings in advertisements separately. This has been done in the column "Advertisements" of the Tables of Data.

It will be noted that but two types, five subordinate features and one associated feature were found in advertisements alone and that these are all low in frequency of occurrence. This tends to show that the list of forms employed in advertisements comprises a more restricted and presumably a more elemental list than that employed in content.

Comparison of Data From Juvenile, Technical, Women's and Total Magazines

Purposes of Comparison

Some evidence of value in the determination of instructional content in graphic forms is afforded by their use in juvenile, women's and technical magazines. One would expect the least frequent use and the lowest complexity of graphic forms to be found in juvenile magazines because of the assumed immaturity and lack of education in the readers of such magazines; and while it must be recognized that only a small minority of our youth read juvenile magazines and those who do are probably

rather highly selected for intelligence and education it would seem that minimum essentials for high school graduates should include at least these items. The returns from juvenile magazines have therefore been separated from the others and the frequency indices and coefficients of distribution calculated. These are presented in the "Magazines-Juvenile" column of the Tables of Data. Since the rank indices of the items in juvenile magazines have no apparent significance in themselves and are not combinable with others they are not included. They can be readily calculated by multiplying the frequency indices by the corresponding coefficients of distribution, should occasion arise for their use.

Any interests peculiar to women which might result in a special use of graphic forms should be apparent in magazines devoted to their interests. The frequency indices and coefficients of distribution of the items found in women's magazines are therefore presented in the Tables of Data in the "Magazines-Women's" column. Rank indices are omitted for the reasons given for juvenile magazines.

It seems reasonable to assume that the current use of graphic forms is unduly restricted by lack of familiarity with the various forms both on the part of authors and readers: an author could not use forms with which he was not familiar however appropriate their use and he should not use those likely to be unfamiliar to his readers, although it is doubtful whether the latter consideration would significantly influence other writers than those of advertisements. It is a function of the curriculum constructor to determine not only existing, but also desirable, uses of possible instruction elements. Some evidence as to the desirable use of graphic forms is afforded by their employment in technical magazines since in technical magazines there is presumably no restriction on their employment because of ignorance on the part of either writers or readers. While such evidence would have to be employed with reservation since topics of interest to the technically trained would presumably require a greater and more elaborate use of graphic forms than those of interest to the non-specialist, returns from technical magazines are included in the *Magazines-Technical* column of the Tables of Data as an

index of the employment of graphic forms by, and for, those assumed to be unhampered by ignorance. Rank indices are omitted for the reasons given for juvenile magazines.

The titles of the women's, juvenile and technical magazines included in the survey are shown in List 1.

Results of Comparison

Maps

The use of maps in the technical magazines did not differ significantly from that of other types of magazine nor did it give indication of presupposing special training; there is, therefore, no "technical" column for maps.

The returns for maps from juvenile and women's magazines seem to have no particular significance in themselves but they are valuable for comparison with other graphic forms since, map reading is a generally accepted part of elementary education.

It is to be noted that maps are less frequent in juvenile and women's magazines than in the total list; some form of map is found in .4 of the annual circulation of the total list and in only .3 and .2 respectively of the annual circulation of juvenile and women's magazines. This should not be considered as determinate, however, for both women and children read newspapers in which the coefficient of distribution for maps is .5 (see table).

Mechanical Drawings

Since no employment of mechanical drawings of any consequence was found in women's magazines the returns are not listed.

Juvenile magazines divide themselves on the basis of types of reader from the standpoint of this study into three classes: those designed for boys alone, those for girls alone and those for boys and girls. Since it was found that the magazines designed for girls alone made no significant use of mechanical drawings, the returns were taken from, and represent, the other two classes.

It is noteworthy that .9 of the total annual circulation of magazines read by boys contains some form of mechanical drawing. It must be remembered that the term "mechanical

drawing" as used in this study covers all types of drawings and pictures of machines which have any degree of the conventional as well as dimensioned orthographic construction drawings. The latter type of drawing alone, however, is more prevalent than maps in these magazines; (see coefficients of distribution in the Juvenile column of Table of Data). This evidence, so far as it goes, therefore, gives more justification to the teaching of certain forms of mechanical drawing than it does to instruction in map reading.

Those graphic forms and elements which were found in technical magazines alone can be detected by the fact that their frequency index is the same for "technical" as it is for "total" magazines. These items are starred on the tables. It will be noted that there are no "types" of drawing employed in the technical magazines which do not also appear in others, and that there are but twelve out of 50 subordinate and two out of 28 associated features which were found only in technical magazines and most of these are low in frequency in the technical magazines. This tends to show that the list of forms and features of mechanical drawing employed in non-technical magazines needs little, if any, supplementing. It furnishes no evidence, however, to show that the frequency of employment of the items is as great as it should be.

Architectural Drawings

The most significant evidence from the comparison of the data of architectural drawings is the notably extensive employment of floor plans in women's magazines. Almost half of the total magazine frequency index for architectural drawings is contributed by women's magazines; five-tenths of the total annual circulation of women's magazines contain some form of architectural drawing as compared with five-tenths for technical magazines and two-tenths for the total list of magazines. Floor plans are over three times as frequent in women's magazines as are maps. Since instruction in the reading of floor plans has not been a part of formal education for women, this widespread use may indicate that women are able to acquire the ability without formal instruction. The matter is worthy of investigation and

if it should be proved that formal instruction is needed the evidence suggests the inclusion of floor plan reading in the formal education of women.

The data from technical architectural magazines indicate that current usage in non-technical magazines is quite comprehensive in the varieties of form used since but one type out of ten, five subordinate features out of sixty-six and one associated feature out of ten were not found in the latter, and the items occurring in technical magazines alone were all of low frequency. No evidence is afforded regarding adequacy in point of frequency of use.

Electric Circuit Diagrams

There is but one technical electrical magazine included in the list of magazines surveyed, the *Radio Broadcast.* This has some circulation among amateurs but the publishers state that an extensive canvass of the purchasers of the magazine indicated that 84 per cent are following radio work as a vocation. The "technical" column, therefore, is based on the contents of this one magazine. In the juvenile column are included only boys' magazines since no significant employment of the items was found in girls' magazines or in magazines intended for both boys and girls.

The frequency of electric circuit diagrams in boys' magazines was found to be about two-thirds as great, proportionately, as the frequency of maps in all juvenile magazines.

The occurrence of electric circuit diagrams in the total magazine survey was low, being found in only .03 of the total annual circulation.

But seven out of 127 subordinate features were found exclusively in the technical magazine and all but one of these was low in frequency in the technical magazine, furnishing significant evidence favorable to the comprehensiveness of the list. Two radio magazines devoted to amateur radio interests which were included in the survey were found to use quite as extensive a list of symbols as the magazine read chiefly by vocational specialists. The rapidly changing nature of the radio art was reflected in the appearance of a considerable number of new

symbols during the survey year due to the introduction of new apparatus. The lack of standardization of the symbols is also apparent; for instance, the three-element tube, the most commonly used tube at present, has two distinct, widely used, symbols Nos. ES10 and ES23.

Graphs

The study of graphs in connection with high school mathematics has grown to be a widespread custom. The content of women's magazines lends far less support to this teaching of graphs to girls than to the teaching of floor plan reading since floor plans occur in six times as many issues as graphs with over fifteen times the frequency.

The occurrence of graphs in juvenile magazines is low, being found in only .05 of the total annual circulation.

Graphs appear widely in technical magazines, having been found in some form in over .9 of the total annual circulation. Only two out of thirty-seven types, however, were found exclusively in technical magazines (nos. GT14 and GT21), both of which are very simple in nature and are low in frequency in the technical magazines. Both also were found in newspapers.

Limitations of the Study

This study makes no attempt to determine conclusively what graphic forms should be included in the curriculum. The determination of the instruction in graphic forms which should be included in the curriculum of the non-specialist would involve at the least adequate evidence regarding the following considerations.

1. Which of the graphic forms thus far devised are needed by the non-specialist
    a. In understanding the written and printed matter pertinent to his efficiency in living;
    b. In the effective expression of his ideas.
2. The degree of probability that the knowledge of graphic forms now needed will continue to be needed in the future.
3. Whether formal instruction is needed in the development

of adequate ability to understand and to use each needed form and, if formal instruction is needed, the nature and amount.

4. To what extent differences in intelligence, interests, extent of education, social and economic position and geographic location influence the need for a graphic vocabulary.

This study attempts only (a) to establish evidence pertinent to point 1a of the above considerations, by determining as well as circumstances permit what might be called the graphic comprehension vocabulary necessary to a full understanding of the current reading matter of non-specialists, (b) to indicate the relative frequency of occurrence and distribution of the respective items and (c) to draw such inferences as may be warranted by the results of the investigation. It is obvious that a full comprehension of all graphic elements contained in a unit of reading matter may not be necessary to a fair understanding of its content and that a person receiving a periodical does not necessarily, or usually, read all of its contents, and therefore does not necessarily need to possess a full understanding of all contained forms used to comprehend those portions which he reads. The determination of such partial vocabularies is beyond the province of this study.

Since all of the above considerations, and perhaps others, are essential to an adequate determination of a graphic curriculum and since this study is concerned only with those designated it is obvious that even though the sufficiency of this study within its field be assumed, adequate determination of the curriculum must await the necessary supplementary studies.

Possible Uses of the Results of this Study

As was pointed out under "Limitations of the Study", this study does not unaided furnish an adequate basis for curriculum determination. There seem to be reasonable grounds for accepting the array of graphic forms which it has yielded as satisfactorily comprehensive of the demand made upon the reader by current reading matter. The appropriate next step would seem to be the formulation of a test of the comprehension of these forms. This test, after satisfactory validation, could be given to

children and adults who had had varying amounts of instruction in the comprehension of the forms, to determine the extent of comprehension ability present in various pertinent groups and classes of the adult population and which items stand in need of formal instruction.

Since any expression vocabulary can be no greater, and usually is appreciably smaller, than the corresponding comprehension vocabulary, the list furnished by this study could be employed also as a basis for a test of expression ability in graphic forms and evidence collected regarding (a) the extent of expression ability present among specialists, non-specialists, men, women and other pertinent groups, (b) the need for greater ability in the various groups, and (c) the need for formal instruction in the various items.

A comparison of the results of this study with the results of similar surveys of appropriate sections of current periodical literature could be made to furnish evidence regarding variations in the use of graphic forms among various classes of readers and in various geographic districts.

A comparison of the results of this study with the results of repetitions after successive periods of years would furnish evidence regarding the relative permanence of, and innovations in, the items of the graphic comprehension vocabulary of the non-specialist.

While the study affords entirely inadequate positive evidence for curriculum determination within its field, the negative evidence which it affords is much stronger. Any instruction in general classes in the comprehension of graphic forms beyond those showing a fairly high degree of frequency of occurrence in this study could hardly be justified on the basis of direct usefulness to the individual and, if included, would have to be justified on some other ground.

It would seem also that with all of their inadequacy, the findings of this study might be more appropriately employed to determine general courses of instruction than to base such courses on the needs and practices of technical specialists or on the opinions of instructors or textbook writers regarding the needs of the non-specialist, as is now the custom. If the study is used

for this purpose, items should be selected for the determination of instruction in the order of their frequency of occurrence and distribution, *i. e.*, in the order of their rank indices, proceeding through the list, in the absence of evidence regarding a limiting frequency, as far as instructional time permits, added weight being given to those items occurring with significant frequency in juvenile magazines and in advertisements.

If the results of this study are used for the determination of instruction it should not be assumed that the classification of graphic forms employed is necessarily best for this purpose; nor is it by any means necessary that instruction in a graphic vocabulary be given in special classes; architectural floor plan reading can readily be included in home economics courses, architectural drawing interpretation and the reading of electric circuit diagrams can be taught in shop or science classes, some forms of map reading are already taught in geography courses and some forms of graph instruction in mathematics courses.

Summary and Conclusions

1. In view of the following considerations the list of graphic forms yielded by this study can be accepted as fairly comprehensive of the demands made upon the non-specialist reader by current reading matter, and the rank indices of the forms can be accepted as fairly indicative of their relative numerical significance.

a. The array of graphic forms presented by this study includes the entire list of those employed in all of the issues of one year of the most representative fifth of current magazines as determined by the method employed.

b. The list of graphic forms from magazines was determined by the method of diminishing returns, by carrying the survey through progressively less representative groups of magazines until an independently determined group of considerable size made no additions of consequence to the types of forms already found.

c. The list from magazines was further checked for

LIST 1

LIST OF MAGAZINES SURVEYED

Sub-List Six

NAME	ISSUES PER YEAR	CIRCULATION	CLASSIFICATION
American Magazine	12	2,200,000	
American Mercury	12	75,000	
Arts and Decoration	12	29,000	
Asia	12	61,000	
Atlantic Monthly	12	143,000	
Bird Lore	6	21,000	
Bookman	12	27,000	
Century	12	24,000	
Collier's Weekly	52	1,669,000	
Country Life	12	36,000	
Current History Magazine	12	67,000	
Delineator	12	1,539,000	Women's
Etude	12	200,000	
Forum	12	95,000	
Golden Book Magazine	12	137,000	
Good Housekeeping	12	1,672,000	Women's
Harper's Magazine	12	117,000	
Independent, The (Discontinued after 10-13-28)	43	12,000	
International Studio	12	17,000	
Ladies' Home Journal	12	2,546,000	Women's
Literary Digest	52	1,593,000	
Living Age	16	29,000	
Magazine of Business	12	202,000	
Mentor	12	101,000	
Nation	52	39,000	
National Geographic	12	1,191,000	
Nature Magazine	12	119,000	
New Republic	52	25,000	
North American Review	12	25,000	
Outlook	52	65,000	
Pictorial Review	12	513,000	Women's
Popular Mechanics	12	557,000	
Radio Broadcast	12	40,000	Technical
Review of Reviews	12	188,000	
St. Nicholas	12	54,000	Juvenile
Saturday Evening Post	52	2,910,000	
Saturday Review of Literature	52	33,000	
Scientific American	12	98,000	
Scribners	12	94,000	
Survey	24	26,000	
Theatre Arts Monthly	12	5,000	
Travel	12	40,000	
Woman's Home Companion	12	2,377,000	Women's
World's Work	12	154,000	
Yale Review	4	2,000	

SUB-LIST FIVE

NAME	ISSUES PER YEAR	CIRCULATION	CLASSIFICATION
American Boy	12	311,000	Juvenile
American Forest and Forest Life	12	18,000	
Architectural Record	12	13,000	Technical
Boys' Life	12	178,000	Juvenile
Child Life	12	212,000	Juvenile
Congressional Digest	10	7,000	
Dial	12	11,000	
Educational Review (Discontinued after 10-28)	7	4,000	
Field and Stream	12	127,000	
Foreign Affairs	4	13,000	
Garden and Homebuilder	12	56,000	
House and Garden	12	140,000	
House Beautiful	12	99,000	
Hygeia	12	70,000	
Life	52	148,000	
Modern Priscilla	12	643,000	Women's
Outdoor Life and Outdoor Recreation	12	116,000	
Photo Era	12	3,000	
Photoplay Magazine	12	561,000	
Popular Radio (Discontinued after 4-28)	4	63,000	
Popular Science Monthly	12	334,000	
Radio News	12	219,000	
Scientific Monthly	12	9,000	
Sunset	12	145,000	
Time	52	193,000	
Vogue	12	147,000	Women's
Youth's Companion	12	259,000	Juvenile

SUB-LIST FOUR

NAME	ISSUES PER YEAR	CIRCULATION	CLASSIFICATION
Adventure	24	113,000	
American Childhood	10	20,000	
American City	12	15,000	Technical
American Cookery	10	43,000	Women's
American Girl	12	53,000	Juvenile
American Lawn Tennis	15	4,000	
American Machinist	52	17,000	Technical
Annuals American Academy Political Science	6	10,000	
Architecture and Building	12	7,000	Technical
Argosy	52	125,000*	
Baseball Magazine	12	76,000	
Better Homes and Gardens	12	1,079,000	
Butterick's Quarterly	4	900,000	Women's
Catholic World	12	5,000	
Children	12	84,000	
Contemporary Review	12	5,000*	
Cosmopolitan	12	1,706,000	
Country Gentleman	12	1,622,000	
Detective Story Magazine	12	125,000*	
Elite Styles	12	51,000	Women's
Everybody's	12	59,000	
Everygirl's Magazine	10	31,000	Juvenile
Factory and Industrial Management	12	34,000	Technical
Far West	12	125,000*	
Forest and Stream	12	105,000	
Harper's Bazaar	12	117,000	Women's
John Martin's Book	12	33,000	Juvenile
Judge	52	194,000	
McCall's Magazine	12	2,307,000	Women's
Missionary Review of the World	12	8,000	
Motion Picture Classic	12	169,000	
Motion Picture Magazine	12	347,000	
Munsey's Magazine	12	408,000	
Musical America	52	14,000	
Musical Courier	52	30,000	
Musician	12	11,000	
Nation's Business	12	272,000	
Needlecraft	12	1,076,000	Women's
Nineteenth Century and After	12	5,000*	
Open Road for Boys	12	66,000	Juvenile
Physical Culture	12	336,000	
Poetry	12	3,000	
Red Book Magazine	12	788,000	
Science and Invention	12	134,000	
Theatre	12	49,000	
Vanity Fair	12	90,000	
Western Story Magazine	52	125,000	
Woman's Journal	12	20,000	Women's

*Estimated.

LIST 2

LIST OF CLASSES OF MAGAZINES

Agriculture
All Fiction
Antiques*
Architecture
Art
Athletics*
Aviation
Baseball
Billiards
(Birds) see Nature
Birth Control*
Boxing*
Business
Citizenship for Women
Clubs*
Collegiate*
Cooking
Current Events
Dogs*
Drama and Theatre
Educational
Executive
Fashions
*Finance**
(Florists) see Home and Landscape
Fraternal*
General
Geography and Travel
Golf*
Health
Home and Landscape
Horse and Hunting*
Humor
Juvenile
Literary
(Mail Order) see general
Matrimonial
Mechanical
Military, Naval and Service News*
(Miscellaneous) see General
Motion Picture
*Motor Boat**
Automobile and Motoring*
Music
Nature
Needlework
Parents
Photography
Poetry
Popular Science and Mechanics
*Poultry**
Radio
Railroad Employees*
Religious
Social Work and Agencies
Society*
Sports*
Tennis
Travel
Women's
Yachting*

Title in *Italics* added to list of S. R. & D. Service.
Titles in parentheses omitted from list of S. R. & D. Service.

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*Classes not represented on list of magazines surveyed.

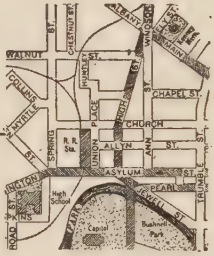
MAPS

PLATE I

MT 1. OUTLINE MAP

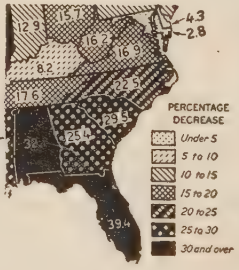
MT 2. LINE MAP

MT 3. STREET MAP

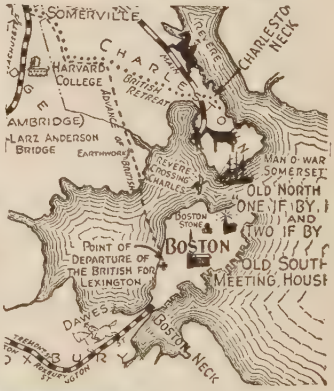


MT 4. ROAD MAP

MT 5. SHADED AREA MAP



MT 6. PICTORIAL MAP

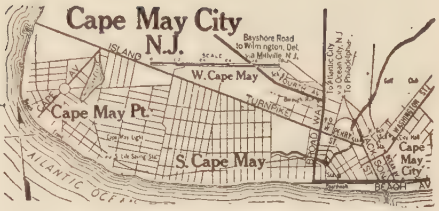


MT 7 RELIEF MAP

PLATE 2

MAPS

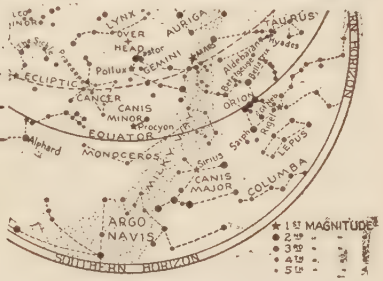
MT 8. CITY MAP



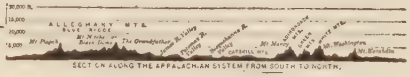
MA 24 ECLIPTIC

MA 21 EQUATOR

MT 9 SKY MAP



MT 10 PROFILE MAP

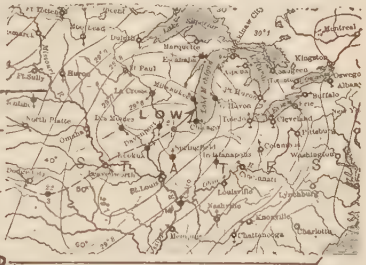


MT 11 GEOLOGIC SECTION

Fig. 3.—Section of the Appalachian Mountains.

MA 52 ISOLINES, ATMOSPHERIC PRESSURE - ISOBARS

MT 12 WEATHER MAP

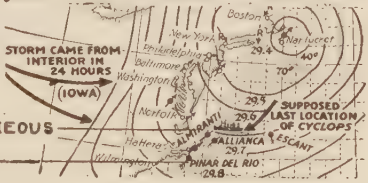


MS 1 SHORE LINE, WATER or LAND SHADED

MA 2 DIRECTION ARROW

MA 7 LOCATION MARKS, MISCELLANEOUS

MA 8 SHADED AREA



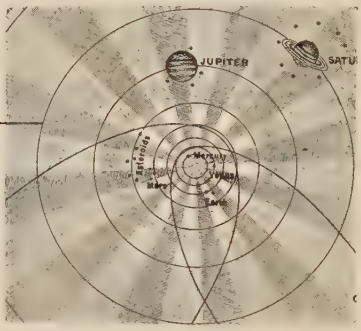
MAPS

PLATE 3

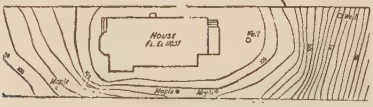
MA 14 CONNECTION LINES

MA 29 DISTANCE CIRCLES

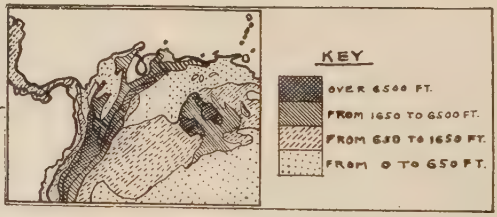
MA 32 ORBIT OF PLANET



MA 41 CONTOUR LINES



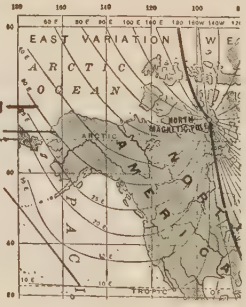
MA 42 CONTOUR AREAS



MA 48 FREQUENCY DOTS

MA 46 ISOLINES OF MAGNETIC DECLINATION

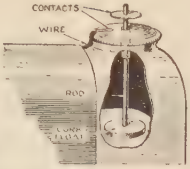
MA 27 CLIMATIC ZONE LINES



MECHANICAL DRAWINGS

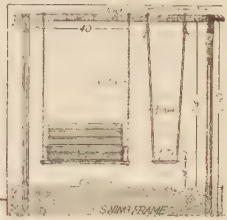
PLATE 4

DT1 CUTAWAY SECTION

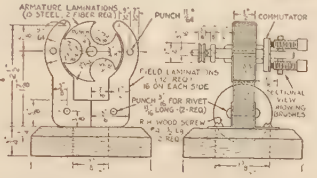


DT2 PLAIN SECTION

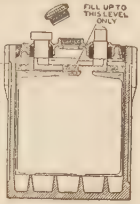
DT3 ONE VIEW, TWO DIMENSIONED



DT4 TWO VIEW VIEWS PROJECTED

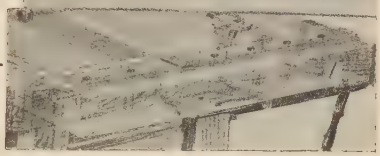

ARMATURE LAMINATIONS (9 STEEL, 2 FIBER REQ)
PUNCH
COMMUTATOR
FIELD LAMINATIONS 1 1/2" REQ'D 16 ON EACH SIDE
PUNCH 5/8" FOR RIVET (LONG - 12 REQ)
R = WOOD SCREW #3 5/8 2 REQ
SECTIONAL VIEW SHOWING BRUSHES

DT6 VERTICAL SECTION

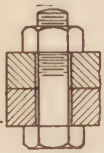


DT5 SHADED SECTION

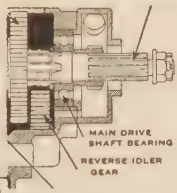
DT7 PHANTOM DRAWING



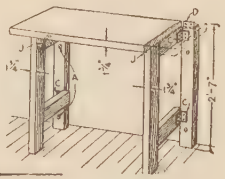
DT8 SECTION WITH TWO ADJACENT SURFACES



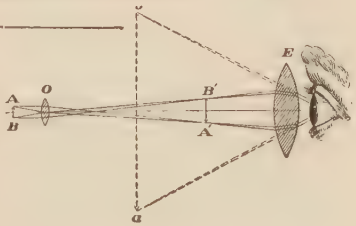
DT9 SECTION WITH THREE ADJACENT SURFACES



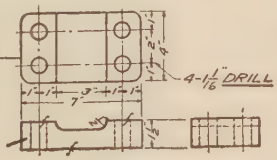
DT10 ONE VIEW, THREE DIMENSIONED



DT11 SECTION OF LIGHT BEAM

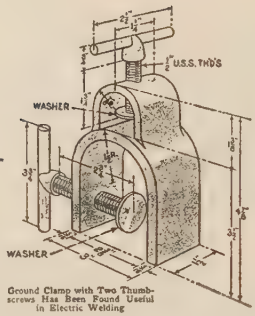


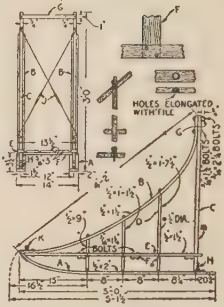
DT12 THREE VIEW, VIEWS PROJECTED



MECHANICAL DRAWINGS

DT 13 ISOMETRIC DRAWING

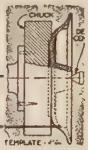




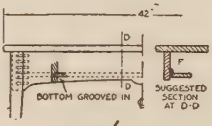
DT 14 TWO VIEW, VIEWS NOT PROJECTED

DT 15 PARTIAL SECTION

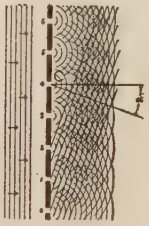
DS 1 DOTTED LINE, HIDDEN PART



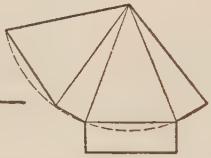
DT 16 SECTION ON DESIGNATED PLANE



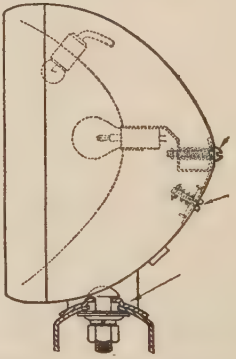
DT 17 WAVE SECTION



DT 18 SURFACE DEVELOPMENT FOR FOLDING

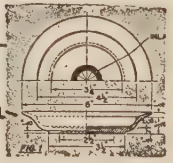


DT 19 PHANTOM SECTION



DT 22 HALF VIEW, SYMMETRICAL

DT 20 HALF SECTION, SYMMETRICAL

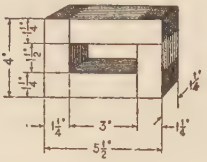


DT 21 RADIOGRAPH

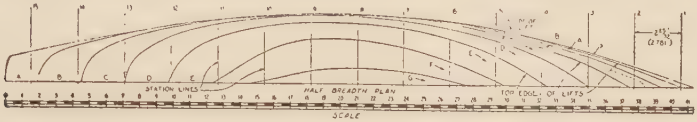
MECHANICAL DRAWINGS

PLATE 6

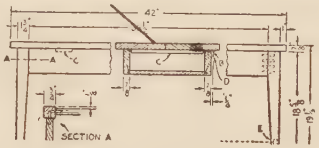
DT 24 OBLIQUE PROJECTION



DT 25 SECTION CONTOURS OF BOAT HULL



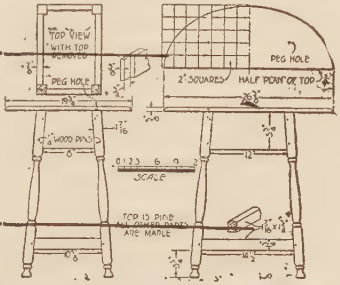
DT 26 REVOLVED SECTION



DA 11 TRANSFER SQUARES

DT 27 FOUR VIEW, VIEWS PROJECTED

DA 9 DIMENSIONS a"x b"

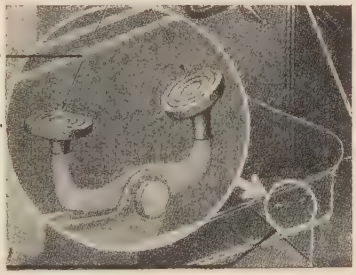


DA 18 DOTTED TREND-LINE

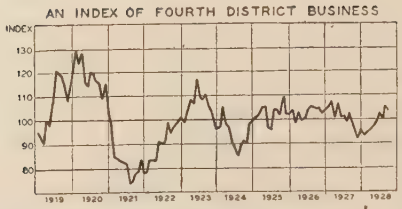
DA 10 EMPHASIS ARROW

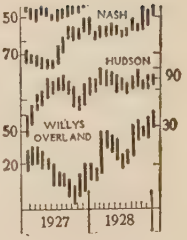
DA 17 ENLARGED INSERT

DA 24 EMPHASIS CIRCLE



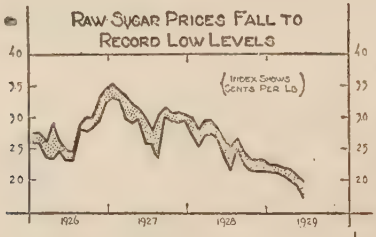
GRAPHS

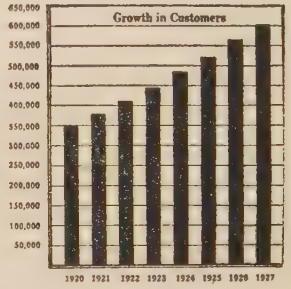




GT1 LINE GRAPH, RECTANGULAR COORDINATES

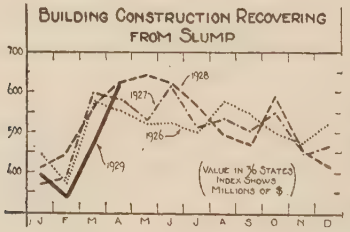
GT2 LINE BAR GRAPH, VERTICAL BARS

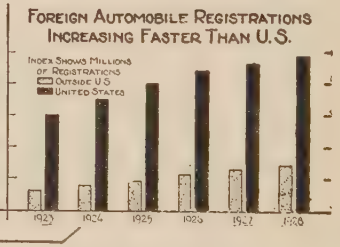




GT3 SHADED AREA GRAPH, TWO AREAS

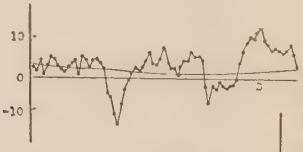
GT4 BAR GRAPH, PLAIN

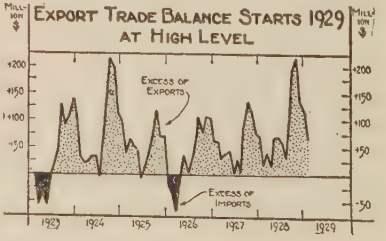




GT5 LINE GRAPH, TWO OR MORE LINES

GT6 BAR GRAPH, BARS PAIRED





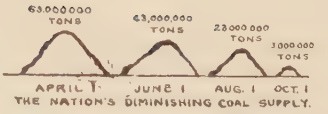
GT7 LINE GRAPH + AND - COORDINATES

GT8 LINE GRAPH, AREA ABOVE OR BELOW A GIVEN ORDINATE SHADED

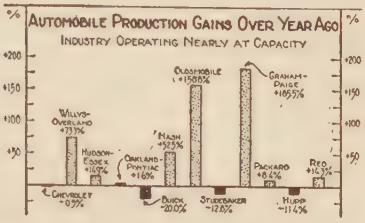
GRAPHS

PLATE 8

GT 9 · PICTOGRAM AREA

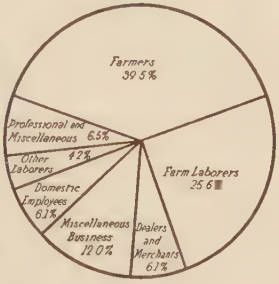


GT 10 BAR GRAPH + AND − COORDINATES

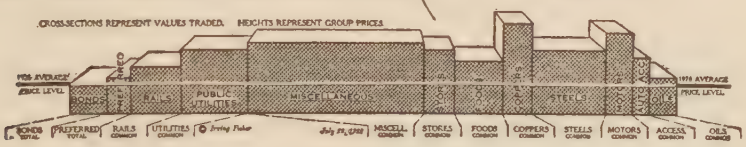


GT 11 SECTORED CIRCLE GRAPH TWO SECTORS

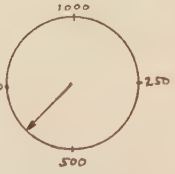
GT 12 SECTORED CIRCLE GRAPH THREE OR MORE SECTORS



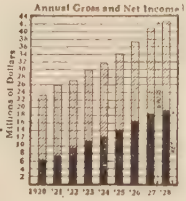
GT 13 AREA GRAPH RECTANGLES



GT 14 CLOCK DIAGRAM



GT 15 BAR GRAPH SECTORS TWO SECTORS



GT 16 LINE GRAPH, POLAR COORDINATES

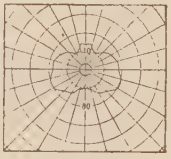


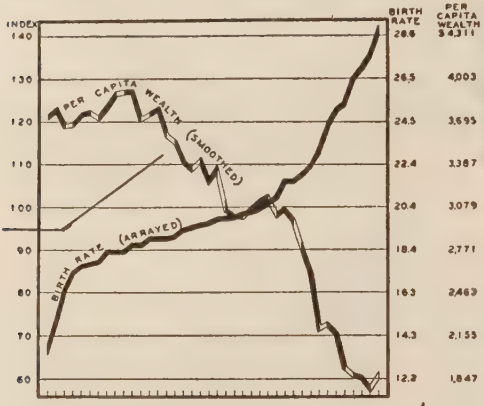
FIG. 57.—The distribution curve for the lamp.

GRAPHS

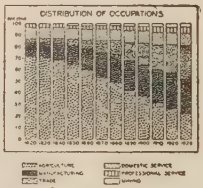
GT 17 PICTOGRAM LINE

GT 18 LINE GRAPH SECTIONED

BIRTH RATE AND PER CAPITA WEALTH FOR FORTY STATES.

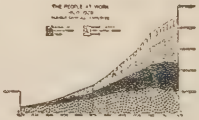


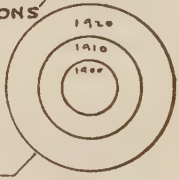
GS 3 TWO VERTICAL SCALES



GT 19 BAR GRAPH SECTIONED, THREE OR MORE SECTIONS

GT 20 SHADED AREA GRAPH THREE OR MORE AREAS-





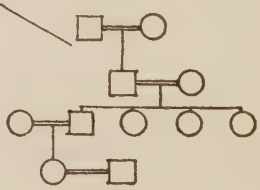
GT 21 AREA GRAPH CONCENTRIC CIRCLES

GT 22 CIRCULAR AREA GRAPH

GT 23 PICTOGRAM VOLUME

POWER IMPULSES OF AN EIGHT CYLINDER AUTO ENGINE.

GT 24 GENEALOGY DIAGRAM



GT 25 LINE GRAPH ONE LOGARITHMIC COORDINATE

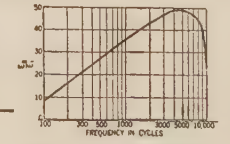


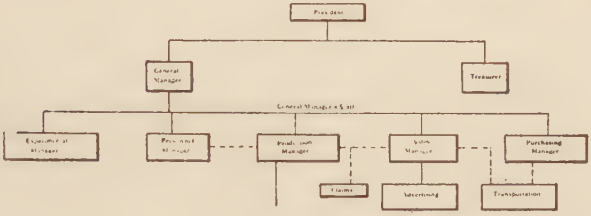
Fig. 2—Frequency characteristics of transformer plotted on logarithmic paper

GRAPHS

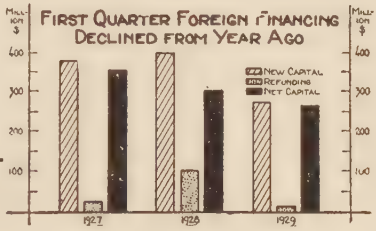
CT 26 SINGLE BAR SECTIONED

CT 27 HISTOGRAM

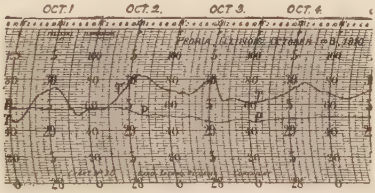
CT 28 ORGANIZATION CHART



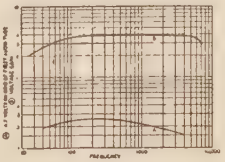
CT 29 BAR GRAPH BARS GROUPED IN SETS



CT 30 LINE GRAPH, CURVED ORDINATES, DRUM RECORDER RECORD



CT 31 LINE GRAPH TWO LOGARITHMIC COORDINATES

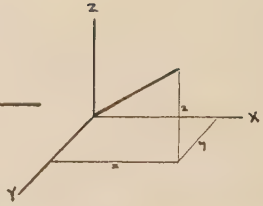


CT 32 VECTOR DIAGRAM

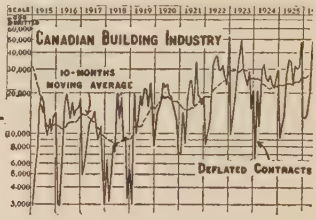
PLATE 11

GRAPHS

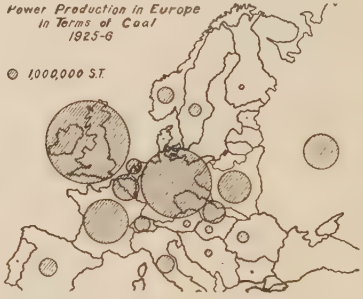
GT 33 LINE GRAPH, THREE COORDINATE AXES



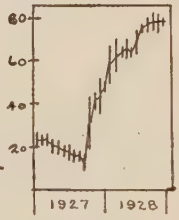
GT 35 LINE GRAPH, WITH LINE OF AVERAGES



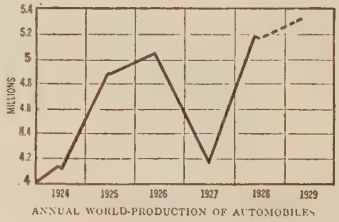
GT 36 AREA GRAPH ADJACENT CIRCLES



GT 37 LINE-BAR GRAPH WITH LINE OF AVERAGES

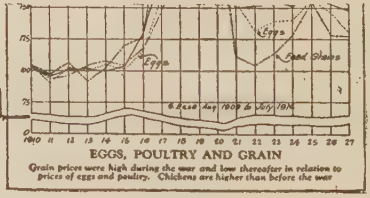


GS 1 PROJECTION OF LINE GRAPH BEYOND DATA



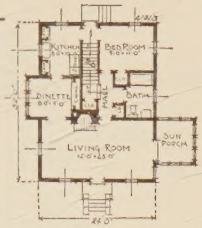
ANNUAL WORLD-PRODUCTION OF AUTOMOBILES

GS 2 OMITTED SECTION

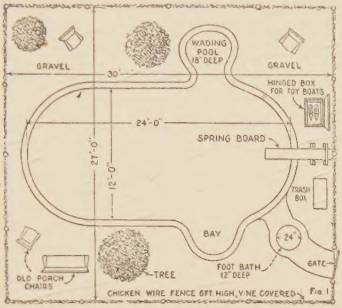

Eggs
Grain Prices
1910 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
EGGS, POULTRY AND GRAIN
Grain prices were high during the war and low thereafter in relation to prices of eggs and poultry. Chickens are higher than before the war

ARCHITECTURAL DRAWINGS

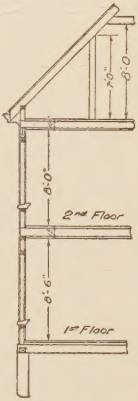
AT 1 FLOOR PLAN OF BUILDING



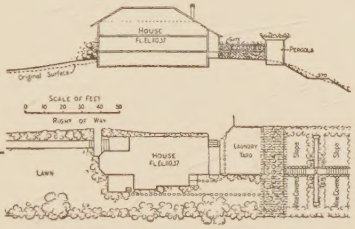
AT 2 PLAN OF ARRANGEMENT OF OBJECTS—



AT 3 VERTICAL SECTION OF BUILDING

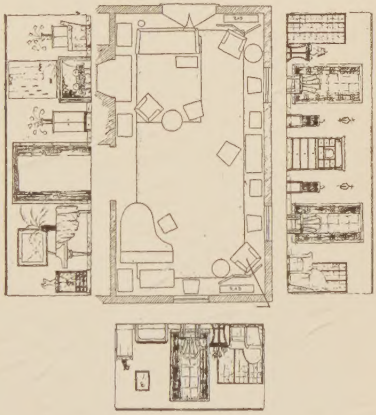


AT 6 ELEVATION OF BUILDING WITH PLAN—



PLAN AND ELEVATIONS OF THE LIVING-ROOM

AT 5 FIVE VIEWS OF ROOM FURNISHING—

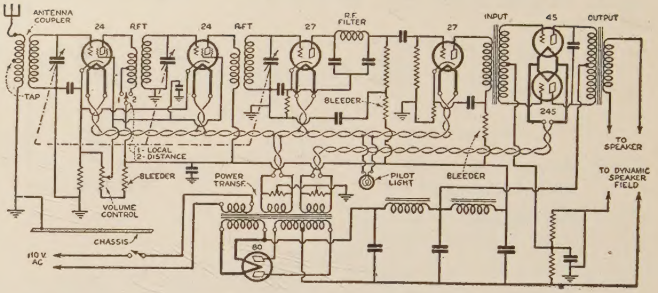


AT 16 MISCELLANEOUS FUNITURE, NOT LABELED—

PLATE 13

ELECTRIC CIRCUIT DIAGRAMS

ELECTRIC CIRCUIT DIAGRAMS



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